



Full length article

Prevalence and pathways of recovery from drug and alcohol problems in the United States population: Implications for practice, research, and policy



John F. Kelly^{a,*}, Brandon Bergman^a, Bettina B. Hoepfner^a, Corrie Vilsaint^a, William L. White^b

^a Recovery Research Institute, Massachusetts General Hospital, 151 Merrimac Street, and Harvard Medical School, Boston, MA, 02114, United States

^b Chestnut Health Systems, W Chestnut St, Bloomington, IL, 61701, United States

ARTICLE INFO

Keywords:

Recovery
Problem resolution
Treatment
Assisted
Unassisted
Mutual-help
Prevalence
Adults
Population

ABSTRACT

Background: Alcohol and other drug (AOD) problems confer a global, prodigious burden of disease, disability, and premature mortality. Even so, little is known regarding how, and by what means, individuals successfully resolve AOD problems. Greater knowledge would inform policy and guide service provision.

Method: Probability-based survey of US adult population estimating: 1) AOD problem resolution prevalence; 2) lifetime use of “assisted” (i.e., treatment/medication, recovery services/mutual help) vs. “unassisted” resolution pathways; 3) correlates of assisted pathway use. Participants (response = 63.4% of 39,809) responding “yes” to, “Did you use to have a problem with alcohol or drugs but no longer do?” assessed on substance use, clinical histories, problem resolution.

Results: Weighted prevalence of problem resolution was 9.1%, with 46% self-identifying as “in recovery”; 53.9% reported “assisted” pathway use. Most utilized support was mutual-help (45.1%, SE = 1.6), followed by treatment (27.6%, SE = 1.4), and emerging recovery support services (21.8%, SE = 1.4), including recovery community centers (6.2%, SE = 0.9). Strongest correlates of “assisted” pathway use were lifetime AOD diagnosis (AOR = 10.8[7.42–15.74], model R² = 0.13), drug court involvement (AOR = 8.1[5.2–12.6], model R² = 0.10), and, inversely, absence of lifetime psychiatric diagnosis (AOR = 0.3[0.2–0.3], model R² = 0.10). Compared to those with primary alcohol problems, those with primary cannabis problems were less likely (AOR = 0.7[0.5–0.9]) and those with opioid problems were more likely (AOR = 2.2[1.4–3.4]) to use assisted pathways. Indices related to severity were related to assisted pathways (R² < 0.03).

Conclusions: Tens of millions of Americans have successfully resolved an AOD problem using a variety of traditional and non-traditional means. Findings suggest a need for a broadening of the menu of self-change and community-based options that can facilitate and support long-term AOD problem resolution.

1. Introduction

The rise in opioid use disorders and opioid overdose deaths in the past 10 years in the US (Rudd et al., 2016a; Rudd et al., 2016b) has occurred within the larger context of a mounting burden of disease, disability, and premature mortality attributable to alcohol and other drug (AOD) use disorders more broadly (Grant et al., 2017; Mokdad et al., 2004; Rehm et al., 2014; Mokdad, 2016). While national concerns are typically focused around the prevalence and impact of these clinically-defined disorders, as noted in the recent Surgeon General’s Report (SGR) on Alcohol, Drugs, and Health (Office of the Surgeon General, 2016), from a broad public health and safety perspective it is important also to recognize that many people who misuse substances actually do not meet diagnostic criteria for an AOD disorder (e.g., based on the diagnostic and statistical manual of mental disorders; [DSM]) but can

still suffer from significant problems. For example, more than 66 million Americans report past-month hazardous/harmful alcohol consumption (i.e., consuming 5+ standard drinks within two hours), increasing risk of motor vehicle crashes, other accidents, social problems, violence, and alcohol-poisonings. While only a minority of these individuals meet the diagnostic threshold for alcohol use disorder, this type of harmful alcohol consumption accounts for three-quarters of the yearly economic burden attributable to alcohol (Center for Behavioral Health Statistics and Quality, 2016). Also, in 2015, 12.5 million individuals reported past-year misuse of a pain reliever—increasing risk for a variety of consequences including overdose—but only 2.9 million met diagnostic criteria for a DSM prescription medication disorder (Office of the Surgeon General, 2016). Given the public health and safety burden conferred by this broad population of individuals engaging in various degrees of problem use, understanding more about them

* Corresponding author at: Recovery Research Institute, Massachusetts General Hospital, 151 Merrimac Street, Boston, MA, 02114, United States.
E-mail address: jkelly11@mg.harvard.edu (J.F. Kelly).

and how they resolve such problems is important, regardless of whether or not they meet criteria for an AOD disorder, per se. As such, the current paper takes a population-level, public health perspective in examining how individuals resolve a wide range of AOD problems.

In fact, an important emphasis of the SGR (Office of the Surgeon General, 2016) was highlighting the large knowledge gaps regarding how people resolve this broad array of problems, often referred to in popular and professional discourse as *recovery* (Betty Ford Institute Consensus Panel, 2007). Epidemiological studies have documented estimates of DSM III remission (e.g., Regier et al., 1990) and high rates of DSM IV remission among those with prior alcohol dependence, with large proportions achieving remission status without the use of any external services (e.g., treatment/mutual-help groups; NESARC, Dawson et al., 2006; Dawson et al., 2007; Lopez-Quintero et al., 2011). Studies examining DSM IV drug (i.e., non-alcohol) dependence remission are less common than those on alcohol dependence remission, though these studies too have documented high rates of remission and slightly smaller proportions achieving this remission status without seeking formal treatment (McCabe et al., 2016). Other large-scale internet-based studies, that have targeted more explicitly those who once had a problem with alcohol/drugs but no longer do (e.g., the “What is Recovery” study; Kaskutas et al., 2014) have focused on how people in recovery define recovery, their demographics and histories, and the types of services they used to help them recover (Kaskutas et al., 2014; Subbaraman and Witbrodt, 2014). Such studies have contributed important new knowledge about the prevalence of remission (especially for more severe alcohol use disorders; i.e., dependence) and the phenomenology of those in recovery. These studies, however, have not yielded national probability-based prevalence estimates of the proportions of US adults successfully resolving a broad array of AOD problems, nor the proportion of these individuals that self-identify as being “in recovery”, estimates specifically called for in the SGR (2016).

Indeed, the value of self-defined problems and their satisfactory resolution has become increasingly more apparent in clinical and public health policy during the past 40 years. There has been a move away from the more clinical “provider-centered” definition of problems and problem resolution, toward “patient-centered” definitions, and recently to a more holistic, “person-centered” perspective (National Academies of Sciences, Engineering, and Medicine, 2017). This person-centric perspective of what constitutes a problem and problem resolution has been particularly true in addiction and mental health, since AOD problems are typified by heterogeneous and dynamic phenotypic expression that can be resolved through a variety of different bio-psycho-social therapeutic inputs (Papadimitriou, 2017). In fact, AOD problem resolution fits well with the biobehavioral principle of “equifinality” (Bertalanffy, 1968), which states that there can be several *different* pathways that lead to the *same* developmental endpoint (i.e., problem resolution). For prevalent AOD problems, for example, these salutary endpoints have been shown to come about through unassisted means (“natural recovery”) as well as “assisted” means (e.g., formal treatment, mutual-help organization participation (Sobell et al., 2000; Moos and Moos, 2006). For others, a more natural problem resolution process of “maturing out” is observed to occur as other developmental demands compete for priority (e.g., marriage, children, work; Lee et al., 2013; Lee et al., 2015a,b; Verges et al., 2012; Winick, 1962). Little is known, however, about this large heterogeneous population of individuals and how they resolve and overcome this broad array of AOD problems.

Here we present findings from the first national probability-based sample of US adults who self-identify as having resolved a significant AOD problem. Specifically, this paper provides estimates of: 1) AOD problem resolution prevalence; 2) lifetime use of “assisted” (i.e., formal treatment/medications, recovery support services/mutual help organizations) vs. “unassisted” resolution pathways; and, 3) correlates of assisted pathway use. Greater knowledge of how different types of individuals engage with the resolution process, particularly from the perspective of service utilization, as well as the demographic and

clinical correlates of using services or not (i.e., assisted vs unassisted), could inform clinical, public health, and policy discourse and ultimately strategies to better address endemic AOD problems.

2. Methods

2.1. Sample and procedure

2.1.1. Eligibility

The National Recovery Survey (NRS) target population was the US noninstitutionalized civilian population 18 years or older that had resolved an AOD problem, indicated by affirmative response to the screener question: “Did you use to have a problem with drugs or alcohol, but no longer do?”.

2.1.2. Recruitment

To obtain a nationally-representative sample of the US population, the research team contracted with the international survey company GfK, using a probability sampling approach to select respondents at random. GfK screened everyone in their “KnowledgePanel” (GfK, 2013), which consists of approximately 55,000 adult individuals (18 and older). The KnowledgePanel uses address-based sampling (ABS) to randomly select individuals from 97% of all U.S. households based on the U.S. Postal Service’s Delivery Sequence File. If necessary, GfK provides individuals with a web-enabled computer and free Internet service. Using this ABS approach, GfK is able to include households that a) have unlisted telephone numbers, b) do not have landline telephones, c) are cell phone only, d) do not have current internet access, and e) do not have devices to access the internet. This type of broad scale sampling helps redress socioeconomic differences in landline telephone use and internet access.

Of note, GfK’s population-based probability sampling approach has been vetted and validated in dozens of published studies in the medical and behavioral health fields (e.g., JAMA, JAMA Internal Medicine; Alcoholism Clinical and Experimental Research, Journal of Personality and Social Psychology, Journal of Consulting and Clinical Psychology, Journal of Clinical Child and Adolescent Psychology, and Journal of Abnormal Psychology. For a complete reference listing see here: [https://www.gfk.com/fileadmin/user_upload/dyna_content/US/documents/GfK](https://www.gfk.com/fileadmin/user_upload/dyna_content/US/documents/GfK_Bibliography.pdf)

[Bibliography.pdf](https://www.gfk.com/fileadmin/user_upload/dyna_content/US/documents/GfK_Bibliography.pdf)). Furthermore, studies have demonstrated that data obtained from the KnowledgePanel are comparable to estimates derived from national surveys that used non-internet methodologies to recruit and collect data, such as household, telephone, or in-person surveys (Bethell et al., 2004; Chang and Krosnick, 2009; Heeren et al., 2008; Novak et al., 2007; Smith, 2003; Yeager et al., 2011). Heeren et al. (2008) for example, showed that estimates of current drinking obtained through a GfK KnowledgePanel-derived sample were similar to those obtained by NESARC.

For the current study, a representative subset of 39,809 individuals from the GfK KnowledgePanel received the screening question (no more than one survey per week can be made available to individual members). In order to draw this subsample, GfK uses a probability proportional to size (PPS) sampling approach, a patented strategy (U.S. Patent No. 7,269,570) unique to GfK. PPS assures that subsamples from a finite panel membership remains a reliable approximation of the entire U.S. Population. See [http://www.knowledgenetworks.com/knpanel/docs/knowledgepanel\(R\)-design-summary-description.pdf](http://www.knowledgenetworks.com/knpanel/docs/knowledgepanel(R)-design-summary-description.pdf) for more information on GfK’s probability-based sampling methodology.

2.1.3. Survey completion and response rate

KnowledgePanel members generally receive invitations for the NRS screening question by e-mail, though, in rare cases, they may also have accessed the screening question from a listing of available surveys on a

central GfK-managed website. Eligible individuals (i.e., answered “yes” to the question, “Did you used to have a problem with drugs or alcohol, but no longer do?”), were linked directly with an online form outlining consent to participate, followed by the survey for those who wished to continue. The survey was first piloted on 20 individuals over 3 days in July 2016 to estimate completion time and identify survey pitfalls. The survey was formally administered over 19 days in July–August 2016.

Of those in the initial sampling frame ($N = 39,809$), 25,229 individuals responded to the screening question (63.4%). This response rate is comparable to most other current nationally representative surveys, including the National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III; 60.1%; Grant et al., 2015) the 2015 National Survey on Drug Use and Health (NSDUH; 58.3%; Center for Behavioral Health Statistics and Quality, 2016) and the 2013–2014 National Health and Nutrition Examination Survey (NHANES; 68.5%; CDC, 2013).

2.1.4. Weighting

To produce unbiased estimates of the population parameters from participants, a two-step approach was employed, called ‘iterative proportional fitting’ (Battaglia et al., 2009). The first step consisted of computation of base weights to reflect unequal selection probabilities, accounting for any under-coverage of the randomly selected sub-sample of the KnowledgePanel, as well as differential response to the NRS screening question. In the second step, post-stratification weighting adjustments were made according to benchmarks from the March 2015 Current Population Survey (CPS; United States Census Bureau, 2015) along eight dimensions: (1) gender (male/female); (2) age (18–29, 30–44, 45–59, and 60+ years); (3) race/Hispanic ethnicity (White/Non-Hispanic, Black/Non-Hispanic, Other/Non-Hispanic, 2+ Races/Non-Hispanic, Hispanic); (4) education (Less than High School, High School, Some College, Bachelor and beyond); (5) census geographical region (Northeast, Midwest, South, West); (6) household income (under \$10k, \$10 K to < \$25k, \$25 K to < \$50k, \$50 K to < \$75k, \$75 +); (7) home ownership status (Own, Rent/Other); and (8) metropolitan area (yes/no). The highest and lowest 1.45% of weights subsequently are trimmed (i.e., those with trimmed weights on the bottom end of the distribution are assigned the weight at 1.45th percentile; those with trimmed weights on the top end are assigned the weight at the 98.55th percentile) and the resulting weights are then scaled to sum up to the unweighted total of all eligible respondents. Regarding weight value interpretation, individuals with characteristics that are under-represented in the sample (relative to CPS geodemographic benchmarks) receive a weight above 1; those who are overrepresented in the sample receive a weight below 1. Weights had median values of 0.642 for Weight 1 (i.e., entire screening sample) and 0.628 for Weight 2 (i.e., target sample of individuals that resolved an AOD problem), suggesting overall, the sample’s geodemographic characteristics were over-represented compared to CPS benchmarks and were weighted down to produce unbiased estimates of the population of U.S. adults. This procedure produced estimates that were virtually identical to the CPS benchmarks (e.g., 64.88% White individuals in CPS vs. 66.64% in the NRS).

Data were collected in July and August 2016 and analyzed between December 2016–July 2017. Median time to completion of the NRS was 24 min ($IQR = 18–36$ min). A thorough systematic investigation of response patterns (Thomas, 2014) led to removal of 45 cases who had to have at least two red flags for invalid survey completion (e.g., did not list a problem substance, unrealistic survey completion time, qualitative responses indicating incorrectly selected “yes” to the screening question), resulting in a final sample of 2002 individuals. Because excluded cases constituted only 2.2% of the original sample ($N = 2047$), derived weights remained valid (Thomas, 2014). Non-Hispanic Black individuals were significantly more likely to be excluded than Whites and males were significantly more likely to be excluded than females ($p < 0.05$). All study procedures were approved by the Partners

HealthCare Institutional Review Board.

2.2. Measures

2.2.1. Problem resolution pathways

2.2.1.1 Assisted vs. Unassisted Problem Resolution. Participants were categorized as having followed an “assisted” resolution pathway if they reported lifetime use of any of the following professional or non-professional recovery management services: 1) Professionally-assisted recovery support (e.g., outpatient or inpatient/residential treatment) (Institute of Behavioral Research, 2002); anti-relapse/craving medication (e.g., naltrexone [oral and injectable] or buprenorphine/naloxone [Suboxone]) (Miller and Del Boca, 1994); mutual-help groups (e.g., AA, NA, SMART Recovery; Kelly et al., 2011); and other community-based recovery support where trained staff typically aid in service provision (e.g., sober living environments, faith-based recovery services, or recovery community centers) (Institute of Behavioral Research, 2002). The classification of the less-formal services (e.g., mutual-help organization participation) in the assisted pathway, arguably might be classified as “unassisted”. We categorized it in this manner because such participation involves engagement with a well-structured external service organization (e.g., AA) involving a clearly delineated recovery program and specific prescribed practices more aligned with assisted pathways. Participants were categorized as having followed an “unassisted” resolution pathway if they reported never having used any of these services.

2.2.2. Other individual characteristics

2.2.2.1. AOD use and recovery-Related characteristics. Participants responded to items from the Form-90 (Miller and Del Boca, 1994) on 1) whether they considered each reported substance a problem, 2) age of first use (from which we dichotomized as < 15 vs. ≥ 15 years) (Center for Behavioral Health Statistics and Quality, 2016) and 3) primary substance (Brown et al., 1998). Participants reported also how long it had been since resolving their problem (trichotomized into 0–5 years; 5–15 years; 15+ years), and whether they considered themselves “in recovery” (yes/no). The survey included items regarding history of alcohol use disorder, other drug use disorders, or one of 16 other psychiatric disorders (“Which of the following substance use and/or mental health conditions have you ever been diagnosed with?”; Dennis et al., 2002).

2.2.2.2. Criminal justice history. Criminal justice history was assessed with items adapted from the Form-90 (Miller and Del Boca, 1994), including lifetime histories of 1) any arrest (yes/no), 2) number of arrests (censored at 51), and 3) drug court participation (yes/no).

2.3. Statistical analysis

We computed weighted frequencies and cross-tabulations to describe the sample, utilization of support services and the relationships between individual characteristics and resolution pathways.

We used logistic regression to identify factors associated with recovery pathway choices, both univariately and multivariately, where adjusted odds ratios (AORs) describe the relationship of the predictor of interest while controlling for demographic variables (i.e., gender, age and race).

3. Results

3.1. Overall Prevalence, Sociodemographic and Clinically Relevant Characteristics of Resolved AOD Problems

The prevalence (SE) of having resolved an AOD problem was 9.1% (0.23%). Of these, just under half (46%, $SE = 0.89$) self-identified as being ‘in recovery’.

Respondents who had resolved an AOD problem tended to be male,

Table 1
Characteristics of U.S. adults who endorsed “used to have a problem with drugs or alcohol, but no longer do” (9.1% (SE = 0.28)).

Demographics	weighted%	SE
Gender		
Female	40.0	1.53
Male	60.0	1.53
Age		
18–24 yrs (emerging adulthood)	7.1	1.16
25–49 yrs (young adults)	45.2	1.63
50–64 yrs (mid-life stage adults, CDC)	34.7	1.43
65+ yrs (older adults)	13.0	0.76
Race and Ethnicity		
White, Non-Hispanic	61.4	1.64
Black, Non-Hispanic	13.8	1.19
Other, Non-Hispanic	5.8	0.92
Hispanic	17.3	1.38
2+ Races, Non-Hispanic	1.7	0.30
Employment Status		
Working—as a paid employee	47.7	1.61
Working—self-employed	7.0	0.78
Not working—on temporary layoff from a job	1.5	0.50
Not working—looking for work	7.7	0.96
Not working—retired	12.0	0.80
Not working—disabled	15.6	1.14
Not working—other	8.5	0.93
Living Accommodations		
With family or other relatives	45.6	1.62
With group of friend(s) or non-family members (non-institutional)	3.6	0.73
Alone in own dwelling	29.7	1.37
Homeless	0.9	0.35
Hospital, rehabilitation facility, nursing home	0.2	0.16
Sober living environment (e.g., halfway house, Oxford House, sober dorm, etc.)	0.5	0.29
Other (please specify):	19.2	1.22
Clinical variables		
Time since problem resolution (in years)		
did not indicate	1.1	0.33
0–5 years	34.5	1.61
5–15 years	35.2	1.54
15+ years	29.3	1.32
Number of substances used 10+ times		
did not specify any substance	0.6	0.26
1 substance	26.8	1.41
2 substances	23.1	1.40
3+ substances	49.5	1.61
Age of onset of first substance		
did not answer	0.8	0.36
< 15 years of age	47.8	1.61
≥ 15 years of age	51.4	1.61
Age of onset of problem substance		
did not identify any problem substance	12.7	1.14
< 15 years of age	34.4	1.54
≥ 15 years of age	52.9	1.61
Primary problem substance^a		
did not identify any problem substance	12.7	1.14
Alcohol	51.2	1.61
Cannabis (e.g., marijuana, hashish)	11.0	1.13
Cocaine (e.g., coke, crack, freebase)	10.0	0.92
Methamphetamine (crank, meth, crystal)	7.3	0.90
Opioids (e.g., heroin, unprescribed fentanyl, methadone)	5.3	0.77
Other	2.6	0.50
Lifetime mental health disorder diagnoses		
Alcohol/substance use disorder	17.0	1.18
Anxiety disorder	22.2	1.27
Mood disorder	18.9	1.19
Other disorder	7.9	0.85
Unsure if diagnosed	8.9	1.01
Never been diagnosed	48.2	1.61
Refused to answer	0.6	0.28

Table 1 (continued)

Demographics	weighted%	SE
History of involvement in a drug court		
Never been arrested	49.0	1.60
Arrested, but no drug court	42.7	1.59
Arrested, and participated in a drug court	7.8	1.01
Refused to answer	0.5	0.27

^a “You said the following substances were a problem for you. Which was your primary substance or drug of choice?”.

aged 25–49 years of age, non-Hispanic White, employed, and living with family or relatives (Table 1). The most common primary problem substance was alcohol, followed by cannabis and cocaine. Roughly half endorsed characteristics suggestive of more severe AOD problems, including substance use onset before age 15, as well use of three or more substances 10+ times. Half also reported history of arrest and, of these, 15% reported drug court participation.

At the time of the survey, it had been several years since many individuals resolved their AOD problem, with 35.2% (1.54%) resolving their AOD problem 5–15 years ago, and 29.3% (1.32%) more than 15 years ago.

3.2. Prevalence of Assisted vs Unassisted Problem Resolution Pathways and Types and Prevalence of Treatment and Recovery Supports Services Used

More than half (53.9%) were in the “assisted” pathway (i.e., lifetime use of one or more AOD treatment or recovery support services; Table 2). The most commonly used services were mutual-help groups (e.g., AA, NA), followed by professional treatment received equally in outpatient and inpatient settings. One in five, overall, utilized non-mutual-help recovery support services (e.g., Faith-based, Recovery Community Centers etc.). 8.6%, reported use of the listed FDA approved anti-craving/anti-relapse medication. Given the recent increase in availability and accessibility to addiction treatment medications (e.g., buprenorphine/naloxone, naltrexone) we wondered whether individuals who had resolved their AOD problem more recently were more likely to report medication use. Results from this subsidiary analysis revealed that, indeed, individuals with more recent problem resolution were more likely to use medications compared to those with longer time since problem resolution (0–5yrs = 14.7%; 5–15yrs = 11.1%; 15+ yrs = 7.7%, $\chi^2 = 15.6$, $p = 0.001$).

3.1. Correlates of assisted AOD problem resolution

Use of one or more “assisted” pathways (i.e., formal treatment, medication, mutual-help, recovery support services) was higher among respondents: in mid-life (50–64 years of age; compared to adults aged 65+); with indicators of greater substance use severity (i.e., lower age of onset; poly-substance use); who received a mental health diagnosis; and with a criminal history, particularly those who had participated in drug courts (Table 3). Use of an assisted pathway differed among primary substances, with significantly higher utilization (compared to alcohol) for opioids and significantly lower utilization for cannabis. These effects largely held in multivariate analyses, which adjusted for age, gender and race. The only exception was with regards to “other disorders”, where the presence of a prior diagnosis of this kind was statistically significantly associated with choosing an assisted pathway after adjusting for demographics, but not univariately. The strongest correlates of choosing an assisted pathway, as indicated by the models’ semi-partial R^2 values (i.e., independent effect), were lifetime diagnosis of a substance use disorder, history of involvement in a drug court, and inversely, not having been diagnosed with any mental health disorder lifetime. Again, these effects held after controlling for demographic variables.

Table 2

Recovery pathway choices of U.S. adults who endorsed “used to have a problem with drugs or alcohol, but no longer do” (9.1% (SE = 0.28)).

Pathway	weighted%	SE
Used support	53.9	1.60
Professionally assisted recovery support (aka formal treatment) (any)	27.6	1.43
Outpatient addiction treatment	16.8	1.21
Inpatient or residential treatment	15.0	1.08
Alcohol/drug detoxification services	9.1	0.91
Anti-relapse/craving medication use (any)	8.6	0.93
Alcohol	4.8	0.70
Antabuse (Disulfiram)	2.4	0.45
Selincro (Nalmefene)	0.8	0.29
Revia (Naltrexone)	0.8	0.29
Campral (Acamprosate)	0.5	0.23
Topamax (Topiramate)	0.5	0.28
Lioresal (Baclofen)	0.2	0.23
Other	0.5	0.17
Opioid	4.4	0.73
Methadone	1.4	0.35
Orlaam (Levomethadyl acetate)	0.5	0.31
Suboxone (Buprenorphine-naloxone)	2.3	0.54
Subutex (Buprenorphine)	1.0	0.36
Revia (Oral naltrexone)	0.2	0.17
Vivitrol (Long-acting injectable naltrexone)	0.4	0.26
Other	0.2	0.09
Recovery support services	21.8	1.40
Faith-based recovery services	9.2	0.94
Sober living environment	8.5	0.95
Recovery community centers	6.2	0.85
State or local recovery community organization	3.0	0.61
College recovery programs/communities	1.7	0.52
Recovery high schools	0.8	0.37
Mutual-help groups	45.1	1.60
Alcoholics Anonymous (AA)	34.6	1.49
Narcotics Anonymous (NA)	17.5	1.23
Cocaine Anonymous (CA)	2.3	0.43
Celebrate Recovery	2.2	0.44
SMART Recovery	1.3	0.35
Women for Sobriety	1.2	0.37
Crystal Methamphetamine Anonymous (CMA)	0.8	0.37
Marijuana Anonymous (MA)	0.9	0.43
LifeRing Secular Recovery	0.4	0.27
Moderation Management	0.2	0.10
Secular Organizations for Sobriety (S.O.S.)	0.2	0.10
Other	3.2	0.47

4. Discussion

This study provides the first national probability-based estimate of the proportion of US adults having resolved an AOD problem. Our national prevalence estimate of 9.1% translates into 22.35 million US adults and is similar to smaller non-probability based estimates of recovery, which have ranged from 5 to 15%, with estimates influenced by differences in remission/recovery definitions and other inclusion criteria (White, 2012; Office of the Surgeon General, 2016). The 9.1% AOD problem resolution estimate is similar to the 9.6% resolution estimate reported in a public health survey of Philadelphia and surrounding counties that used a similar methodology (White et al., 2013). Our findings extend that evidence by providing a nation-wide, probability-based estimate. Additionally, in this survey we asked separately about AOD problem resolution and those defining themselves as, “being in recovery”. Recovery has emerged as a broadly used term in popular and scientific discourse to describe the broad phenomenon under investigation (Betty Ford Institute Consensus Panel, 2007; Kaskutas et al., 2014). Our study adds to this discourse in showing that “being in recovery” is clearly not synonymous with “resolving an AOD problem” for many individuals overcoming such a problem, with only half of our sample self-identifying in that manner. This discrepancy has

implications for our public and policy discourse around “recovery”. While convenient, the choice of individuals to self-define or not in this way may be strongly affected by fear of social stigma (Kelly and Westerhoff, 2010) and the extent to which individuals who have resolved significant AOD problems wish, or feel a need, to incorporate that experience into their life narrative and personal identity (White and Kurtz, 2006). The use of more inclusive language may contribute to the improved reach of, and engagement with, support services aimed at assisting persons suffering from the broad array of AOD problems. For example, instead of describing individuals with AOD problems who are looking to change their substance use as “seeking recovery”, they could be described as “seeking recovery or seeking to resolve an AOD problem” and instead of purely “in recovery”, such individuals could be described as “being in recovery or having resolved a significant AOD problem”.

4.1. Assisted vs. unassisted problem resolution pathways

Our findings further show that a large proportion of US adults resolve an AOD problem without any external assistance. This phenomenon, often referred to as “natural recovery”, has been reported for many years, but accurate national prevalence estimates have been lacking, or where available, focus largely on recovery from problematic alcohol use (Sobell et al., 2000; Dawson et al., 2005; McCabe and West, 2017). In our study, we found that having a less severe and less complex substance and mental health history were associated with using an unassisted resolution pathway. This finding is similar to previous studies which have found those with a less severe clinical history to be more likely to resolve AOD problems without external assistance (Hasin and Grant, 1995; Schutte et al., 2006). Noteworthy also was the finding that respondents whose primary substance was cannabis were less likely to utilize any type of external assistance than those with other primary substances (cannabis primary individuals had one third lower odds of having used formal services compared to alcohol primary individuals). It may be that the impact of cannabis-related problems on individuals’ physiology and life contexts is less dramatic than other primary substances (e.g., clinically-managed withdrawal is not medically indicated), requiring reduced need for external resources to resolve these problems (Ellingstad et al., 2006; Stea et al., 2015).

Use of an assisted pathway was largely unrelated to demographic characteristics such as sex and race, suggesting treatment and recovery support resources are utilized equitably across gender and race groups. That said, participant age (but not time since problem resolution) was related to recovery resource utilization, though only to a small degree ($R^2 = 0.01$). Prior drug court involvement had a stronger association with using an assisted pathway ($R^2 = 0.09$), and there was a further independent association of prior arrest (without drug court). These effects point to potentially helpful clinical and public health roles of drug courts, in particular, and the criminal justice system in general, in facilitating AOD treatment and recovery support services engagement, although the precise mechanisms by which it does so remain to be clarified.

In keeping with other studies examining recovery support services (Weisner et al., 1995; Center for Behavioral Health Statistics and Quality, 2016), our findings demonstrate that the most commonly sought source of help used for AOD problem resolution was mutual-help organizations like AA and NA (45% overall). These are free and ubiquitous resources and appear to play an important public health role in ameliorating the AOD problem burden (Kelly, 2017a; Kelly, 2017b). The second most commonly sought source of help was formal treatment (28%). Noteworthy too, was that a substantial proportion of those resolving an AOD problem (22%) utilized community-based recovery support services that have become more available only in the past 15–20 years, such as faith-based recovery services, sober living environments, and recovery community centers. Apart from sober living environments (Polcin and Borkman, 2008; Jason and Ferrari, 2010),

Table 3
Factors associated with choosing assisted (54%) vs. unassisted problem resolution.

Variable	assisted		univariate		r-sq	multivariable				
	%	SE	OR ^a	95% CI		AOR ^b	95% CI	r-sq		
Demographics										
Gender										
Female	51.8	2.32	0.87	(0.73, 1.04)	0.00	0.88	(0.73, 1.06)		0.01	
Male	55.3	2.17	1.00	[Reference]		1.00	[Reference]			
Age										
18–24 yrs (emerging adulthood)	54.4	8.56	1.29	(0.85, 1.95)	0.01	1.30	(0.86, 1.97)		0.01	
25–49 yrs (young adults)	50.0	2.63	1.08	(0.82, 1.42)		1.11	(0.83, 1.47)			
50–64 yrs (mid-life stage adults)	61.1	2.24	1.69	(1.27, 2.26)	**	1.71	(1.28, 2.28)	**		
65+ yrs (older adults)	48.1	2.84	1.00	[Reference]		1.00	[Reference]			
Race										
White, Non-Hispanic	53.4	1.84	1.00	[Reference]	0.00	1.00	[Reference]		0.01	
Black, Non-Hispanic	57.9	4.66	1.20	(0.92, 1.56)		1.23	(0.94, 1.60)			
Other, Non-Hispanic	60.2	8.13	1.32	(0.89, 1.94)		1.33	(0.90, 1.97)			
Hispanic	50.4	4.51	0.89	(0.70, 1.13)		0.90	(0.71, 1.15)			
2+ Races, Non-Hispanic	51.8	8.64	0.94	(0.47, 1.85)		0.91	(0.46, 1.80)			
Clinically relevant indices										
Time since problem resolution (in years)										
0–5 years	53.7	3.02	1.00	[Reference]	0.00	1.00	[Reference]		0.02	
5–15 years	53.1	2.74	0.98	(0.79, 1.21)		0.90	(0.71, 1.13)			
15+ years	54.7	2.44	1.04	(0.83, 1.30)		0.85	(0.65, 1.11)			
Number of substances used 10+ times^c										
1 substance	46.1	3.05	1.00	[Reference]	0.01	1.00	[Reference]		0.03	
2 substances	53.4	3.48	1.34	(1.04, 1.72)	*	1.32	(1.02, 1.70)	*		
3+ substances	58.5	2.21	1.65	(1.33, 2.04)	**	1.63	(1.31, 2.03)	**		
Age of onset of first substance^c										
< 15 years of age	58.8	2.32	1.47	(1.23, 1.75)	**	1.46	(1.21, 1.75)	**	0.02	
≥ 15 years of age	49.3	2.18	1.00	[Reference]		1.00	[Reference]			
Age of onset of problem substance^c										
< 15 years of age	61.4	2.68	1.42	(1.17, 1.73)	**	1.42	(1.17, 1.74)	**	0.04	
≥ 15 years of age	52.8	2.14	1.00	[Reference]		1.00	[Reference]			
Primary substance^c										
Alcohol										
Cannabis (e.g., marijuana, hashish)	55.9	2.10	1.00	[Reference]	0.02	1.00	[Reference]		0.04	
Cocaine (e.g., coke, crack, freebase)	45.8	5.53	0.67	(0.50, 0.90)	**	0.66	(0.49, 0.89)	**		
Methamphetamine (crank, meth)	58.9	4.72	1.13	(0.83, 1.54)		1.03	(0.75, 1.42)			
Opioids (e.g., heroin, methadone)	59.7	6.32	1.17	(0.82, 1.67)		1.29	(0.89, 1.85)			
Other	71.5	6.75	1.98	(1.27, 3.08)	**	2.17	(1.38, 3.41)	**		
53.8	9.44	0.92	(0.53, 1.61)		1.04	(0.59, 1.83)				
Lifetime mental health disorder diagnoses										
Substance use disorder (vs. not)	90.2	1.89	10.64	(7.33, 15.44)	**	0.12	10.81	(7.42, 15.74)	**	0.13
Anxiety disorder (vs. not)	68.4	2.84	2.19	(1.75, 2.74)	**	0.02	2.40	(1.90, 3.02)	**	0.04
Mood disorder (vs. not)	67.1	3.22	1.97	(1.56, 2.50)	**	0.02	2.12	(1.66, 2.70)	**	0.03
Other disorder (vs. not)	61.0	5.61	1.37	(0.98, 1.92)	**	0.00	1.46	(1.04, 2.06)	*	0.02
Never been diagnosed (vs. not)	38.9	2.25	0.30	(0.25, 0.36)	**	0.08	0.27	(0.23, 0.33)	**	0.10
History of involvement in a drug court^b										
Never been arrested	39.8	2.17	1.00	[Reference]	0.09	1.00	[Reference]		0.10	
Arrested, no drug court	64.3	2.37	2.72	(2.25, 3.30)	**	2.79	(2.29, 3.41)	**		
Arrested, drug court	83.1	4.09	7.47	(4.81, 11.60)	**	8.06	(5.15, 12.63)	**		

Abbreviations: ^a OR, odds ratio; ^b AOR, adjusted odds ratio, adjusted for gender, age and race; ^c not shown are statistics for participants who did not answer this question, though they were included in analyses as a separate category as described in Table 1; * p < 0.05, ** p < 0.01.

little is known about these recovery support services – an important knowledge gap given that they appear to be used at least by a substantial minority of individuals around the United States. In contrast, use of FDA-approved medications specifically to treat alcohol and opioids was generally low. Of note, however, was that use of medications was more prevalent among cohorts with more recent AOD problem resolution reflecting perhaps the more recent availability and promotion of addiction medicines (Oliva et al., 2013; Wen et al., 2017). Increased emphasis on the dissemination of medications for opioid use disorder as effective interventions to address the opioid overdose epidemic, among scientists, clinicians, and policy makers may lead to even greater use of these medications and potentially greater opioid use problem resolution. Follow-up studies focused on the impact of major

policy changes related to AOD treatment and problem resolution (e.g., 21st Century Cures Act) will help answer this key public health question.

Overall, these findings on assisted vs unassisted problem resolution pathway have implications for fiscal appropriations and health services planning and policy efforts in addressing AOD problems since only roughly half of those an AOD problem are likely to use some kind of formal service to help resolve it; namely, those with greater personal vulnerability characterized by markers of higher addiction severity and co-occurring mental health problems. Also, the criminal justice system appears to play a powerful role in directing individuals into AOD services to help resolve substance-related problems. Given that crime so often can be driven by AOD problems (Hartney and Vuong, 2009; Evans

et al., 2017), greater diversion to drug courts rather than incarceration could reduce crime recidivism and enhance public health and safety, but these resources remain underutilized (Crits-Christoph et al., 1999; Litt et al., 2009).

4.2. Limitations

The study's findings should be considered in light of important limitations. The screener question was open to interpretation, where “a drug or alcohol problem” was participant-defined and did not necessarily signify the presence of a diagnosable AOD disorder. Thus, it should be kept in mind that the term “resolution of an AOD problem” we use in this paper may certainly overlap with but not necessarily signify diagnostic remission. This study captures the broader population of individuals who perceive at least some kind of self-defined problem with AOD use. This level of AOD problem severity still has high public health significance because there are a large proportion of individuals who engage in consequential AOD use (e.g., drive while intoxicated/get a DUI), but do not meet diagnostic criteria for AOD disorder. Importantly, our use of the term “pathways” may give an impression that longitudinal trajectory-type analyses of the same individuals over time were used; given the cross-sectional design, therefore, appropriate caution should be taken when making inferences about dynamic changes in the same individuals, as well as any causal connections among variables. The use of the “pathways” label was based on prior research and clinical and theoretical conceptualizations relating to dynamic recovery-related change. Related to this, the data and analyses are limited by the lack of detailed information captured about substance use and clinical histories and patterns of service use and periods of problem resolution and problem reoccurrence over time. Future research should attempt to capture more details in this regard both cross-sectionally as well as prospectively.

5. Conclusions

Our findings suggest that tens of millions of Americans report successfully resolving an AOD problem through a variety of different means, though only half formally self-identify as being “in recovery”. Despite commonly held beliefs about the rarity of AOD problem resolution and how it is achieved, findings underscore the widespread prevalence of such resolution and considerable heterogeneity in resolution pathways. Many resolve AOD problems without the use of any formal addiction services. Use of FDA-approved medications was rare; it is plausible that wider prescribing practices could increase long-term AOD problem resolution rates at a population level (Weiss and Rao, 2017). Improved understanding of this large population of individuals and how they have been successful (Kelly, 2017c; McKay, 2017) could inform and enhance our broad public health as well as clinical, research, and policy efforts in addressing endemic concerns related to AOD misuse. Results suggest that as a society struggling with the impact of substance-related problems, there may need to be a widening of the menu of self-change and community-based options that can facilitate and support long-term AOD problem resolution.

Conflict of interest

The authors have no conflict of interest, including specific financial interests and relationships and affiliations relevant to the subject of this manuscript.

Funding

This research was supported by the Recovery Research Institute at the Massachusetts General Hospital, Harvard Medical School.

Contributors

Author Kelly conceived the study and wrote the protocol. Authors Kelly, Bergman, Hoepfner, Vilsaint, and White managed the literature searches and summaries of previous related work. Author Hoepfner undertook the statistical analysis, and author Kelly wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

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