RESEARCH ARTICLE

Drug-related stigma among people who inject drugs – development and validation of the drug use stigma scale (DUSS)

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Data availability statement: Survey data related to the development of the Drug Use Stigma Scale (DUSS) are available at https://www.openicpsr.org/openicpsr/project/240104/version/V1/view.

Abstract

Drug use is a highly stigmatized behavior, and drug-related stigma is a key driver of behavioral risk, lower health care utilization, and associated adverse health outcomes among people who inject drugs (PWID). While instruments exist for measuring drug-related stigma, their applicability to community-based PWID across multiple stigma types (enacted, anticipated, internalized) and settings (health care, society, family) is limited, as most were developed using treatment-based samples and all were developed in urban populations. This study sought to develop a Drug Use Stigma Scale (DUSS) that addresses these limitations. We developed an initial list of 39 items based on literature review and qualitative interviews (N = 27) and three focus groups (N = 28) with PWID recruited from syringe services programs and via peer referral in two predominantly rural West Virginia counties. The scale items were administered in a survey to 336 PWID recruited from the same two counties divided into development and validation samples. Responses to the 39-item scale went through a multidimensional refinement process, including examination of internal consistency, Confirmatory Factor Analysis (CFA), and a three-factor CFA based on stigma setting. Next, a set of final measurement CFAs were conducted. Finally, the resulting scale was examined for criterion-related concurrent validation. The final DUSS consisted of 16 items with excellent fit statistics for the development sample: SRMR: 0.03, RMSEA: 0.09, GFI: 0.92, CFI: 0.96, NFI: 0.94. Fit attenuated but remained satisfactory for the validation sample. DUSS scores were significantly associated with increased odds of not seeking healthcare when needed (OR: 1.47, $p = 0.001$; OR: 1.61, $p < 0.0001$) after controlling for gender and age. Thus, the resulting scale, the DUSS, demonstrates strong validity and internal reliability across multiple stigma mechanisms and settings in a rural population, making it a valuable

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tool for broadly assessing drug-related stigma and related intervention effectiveness among PWID.

Introduction

Drug use is a highly stigmatized behavior, and people who inject drugs (PWID) experience even greater stigma than those who use drugs through non-injection routes [1,2]. Research suggests that drug-related stigma in healthcare and social settings is a key driver of behavioral risk, lower healthcare utilization, and associated adverse health outcomes among PWID [3–7]. These include studies linking stigma to high risk injection practices [8], drug overdose [9,10], lower uptake of HIV prevention services [7,11–17], and delayed medical care (e.g., for injection-related infections) [4,6,7,18–21]. Experiences of drug-related stigma are also associated with poor mental health [10,22], including lower self-esteem and greater depression, anxiety, and suicidal ideation [23–26]. As the evidence supporting the adverse impacts of drug-related stigma has grown, so too have the calls for effective stigma reduction interventions [27–29]. Despite these findings and calls for action, PWID have not been centered in efforts to develop valid and reliable measures of drug-related stigma.

The literature on drug-related stigma highlights the challenges inherent in measuring a concept as complex as stigma, which Erving Goffman broadly defined as "an attribute that is deeply discrediting." [30]. Existing peer-reviewed research on substance use stigma is largely qualitative and draws from multiple theoretical frameworks. The literature describes key mechanisms through which people who use drugs experience stigma; these include enacted stigma (experiences of unfair treatment or discrimination due to association with a stigmatized group), anticipated stigma (the expectation of being discriminated against or treated poorly because of a stigmatized identity), and internalized stigma (adopting negative beliefs and attitudes about oneself based on a stigmatized identity) [31,32]. These categorizations were derived from a broad and interdisciplinary body of stigma-related literature. For example, a review of previous research on stigma theory identified the mechanisms by which individuals with HIV encounter stigma; the resulting HIV Stigma Framework [33,34] outlined the categories of enacted, anticipated, and internalized stigma that have now been widely applied to substance use stigma as well [32].

Quantitative efforts to develop a drug-related stigma scale applicable to U.S. PWID have a variety of limitations. Most rely on in-treatment samples, which represent only a small percentage of people who use drugs in the U.S. and may include individuals with alcohol use disorders who do not use criminalized drugs [2,35–38]. Some scales limit their focus to a certain type of stigma [2,36,37,39] or a specific setting where stigma is encountered (e.g., health care settings) [39,40], limiting their applicability. There have been efforts to develop stigma scales exclusive to PWID in other countries, but their generalizability to U.S. PWID has not been tested [8,41]. The result is that we lack a valid and reliable scale to assess drug-related stigma experienced by U.S. PWID across different settings, limiting our ability to comprehensively assess stigma and address stigma in this population.

Perhaps the most comprehensive of the existing drug-related stigma scales is the Substance Use Stigma Mechanisms Scale (SU-SMS) developed by Smith and colleagues [38], which was directly informed by the HIV Stigma Framework [33,34]. Smith's 18-item scale (6 items each assessing enacted, anticipated, and internalized stigma, respectively) has high internal validity and reliability, as well as the ability to differentiate between these three distinct stigma mechanisms with respect to two separate sources (i.e., family and health care providers). In the decade since its introduction the SU-SMS has been employed by multiple studies [42–46] and validated in other countries [47–50]. However, its generalizability to stigma encountered by community-based PWID is likely limited because it was developed and validated in a sample consisting solely of in-care patients (methadone maintenance and individuals in HIV treatment), of whom only 9% had recently injected drugs. The sole focus on health care providers and family members is also limiting, as PWID are often marginalized from the health care system and estranged from family members.

Following the publication of the SU-SMS there have been additional efforts to develop a stigma scale specifically for PWID. For example, Fong et al. [40] developed and validated a scale to measure "medical provider stigma experience by people who use drugs" (MPS-PWUD) using a New York City based sample of community-recruited PWID but examined only enacted and internalized stigma in medical settings. Patel et al. [41] also used a community-based sample of PWID in 12 Indian cities to develop a more comprehensive drug use stigma scale addressing four types of stigma (enacted, internalized, vicarious, felt normative) in both health care and community settings, but included questions that are specific to Indian culture (e.g., "PWUD are paying for their karma or sins"); to the best of our knowledge, this scale has not been validated in a U.S. sample.

An additional limitation of these instruments is that they have been, without exception, developed in urban populations. This raises concerns regarding their generalizability to U.S. rural populations, who have experienced an unprecedented increase in injection drug use over the past decade [51,52] with accompanying risk of related infections [53,54]. Recent injection-associated HIV outbreaks and increases in injection-related endocarditis in rural communities [55–57] provide evidence of the need for stigma measurement instruments that have validity and reliability in rural settings. Recent studies have documented that drug-related stigma is a concern for PWID in non-urban communities due to its impact on health services access and utilization [58–60].

In this study, we sought to develop and validate a Drug Use Stigma Scale (DUSS) for community based PWID that can be used to assess multiple types of stigma across multiple settings. We were particularly interested in developing a scale that could help inform community intervention targets for stigma reduction. We recruited from two rural communities in West Virginia to ensure applicability to rural PWID populations.

Materials and methods

Data collection for this study was conducted between May 23, 2023, and August 8, 2024. All research activities were approved by the West Virginia University Institutional Review Board (IRB) and all participants provided informed consent. To ensure anonymity for study participants, the WVU IRB approved a waiver of documented consent and related protocols for all phases for the study. For qualitative data collections, participants reviewed an IRB-approved consent form and provided verbal consent to participate. For quantitative data collection, participants reviewed an IRB-approved consent form as part of the computer-administered survey and indicated their consent by clicking on the appropriate response option before moving on to the survey instrument.

Scale development efforts progressed in phases with PWID input in each step of the development process. First, we used qualitative inquiry to adapt and expand scale items from the existing stigma literature. This involved in-depth interviews with PWID (N = 27) to augment questions from existing stigma scales, followed by three PWID focus groups (N = 28) designed to "member check" our interview findings to improve depth of knowledge and explore any additional areas of stigma lived experience. Based on this qualitative work and consultation with external experts we developed a preliminary 39-item stigma scale that was refined to a final 16-item scale (the DUSS) based on PWID survey responses (N = 336).

More specific information on the methods involved in each of these data collection and analysis phases is provided in the following sections.

Scale development

First, we established the following working definition of drug-related stigma in the community as after an extensive review of the literature: *Negative and unfair treatment that is perceived, anticipated, or experienced in community settings by those identified as using/injecting drugs. Considers both internal and external stigmatization associated with public settings, health care settings, drug treatment settings, family units, and drug using communities.*

Our aim was to develop a measure that captured a range of drug-related stigma perceptions and experiences, was valid and reliable among PWID, and could be tested in future research for use with individuals who use non-injection as well as injection drugs. We focused our development efforts on PWID, who experience the greatest degree of drug-related stigma and have been largely overlooked in previous research in this area.

Qualitative data collection and analysis. We used qualitative inquiry to adapt and expand scale items from the existing literature. Qualitative interview and focus group guides were aligned with the definition above to ensure representation of stigma types (anticipated, internalized, enacted) and settings (including family, society, and healthcare).

PWID who participated in qualitative interviews and focus groups were recruited in two West Virginia counties ("County A" and "County B") using both direct recruitment by study staff at syringe services programs and peer referral. Eligibility requirements included being at least 18 years old and injecting illicit drugs in the past six months. Participants were reimbursed $40 for their time.

We conducted 27 interviews between May and October, 2023, exploring participants' experiences with drug-related stigma in health care settings; in society more generally; and in interactions with family, police, and other people who use drugs. Interviews were recorded and transcribed verbatim. Based on careful reading of the transcripts we developed a preliminary coding scheme consisting of primary domains from the interview guide (deductive) and emergent themes (deductive), then developed a codebook from this coding scheme and further emergent themes. The codebook was piloted by two research assistants across four transcripts and the remaining transcripts were coded by both RAs, comparing coding for consistency and refining the codebook as necessary.

In May 2024 we convened three focus groups involving 28 PWID for the purpose of "member checking" [61,62] our qualitative interview findings. We presented each group with themes resulting from the qualitative interviews and asked for assistance in understanding these themes in more depth and identifying any experiences of drug-related stigma not already included in our analysis. Focus groups were recorded and transcribed and content was reviewed to inform the drafting of preliminary stigma scale questions.

Based on these efforts we developed a draft stigma scale that included selected questions from the literature (both verbatim and adapted) and new questions, consistent with our thematic analysis and member checking efforts.

PWID and subject matter expert review. We consulted both PWID and subject matter experts to refine the draft scale instrument. In June 2023, we conducted cognitive interviews [63,64] with four PWID to assess understanding and improve clarity of the scale items. Participants self-administered the draft scale and then were asked to discuss their overall impression of the instrument, their understanding of the questions, and the alignment of the questions with their own experiences of stigma. We also asked about their experience in reading and responding to the questions to detect any questions that might themselves be stigmatizing to PWID. The interviews were recorded and transcribed verbatim and then reviewed to identify areas for clarification and the need for additional scale items.

Also in June 2023, we distributed the draft scale to four external experts with experience conducting research on injection drug use and stigma. These experts provided feedback on question wording and clarity and recommended additional questions for inclusion.

After refinement we finalized the scale, which consisted of 39 items representing multiple stigma types (anticipated, internalized, and enacted) and relevant settings (family, society, and healthcare). All items were adapted to utilize a 5-point Likert-type response scale, including 1 "Strongly disagree", 2 "Disagree", 3 "Neither agree nor disagree", 4 "Agree", and 5 "Strongly agree". Options were also given for "Not applicable" and "Refuse to answer".

Scale refinement

Survey recruitment and data collection. PWID recruitment was conducted in the same two West Virginia counties using the same methods, eligibility, and reimbursement as the scale development activities. Informed consent, screening questions, and survey were self-administered by participants on laptop computers using REDCap software [65,66]. The survey contained the 39-item stigma scale as well as questions on sociodemographics, drug use, health care experiences, HIV risk and services engagement, the HIV-related stigma scale [67], and additional questions regarding lived experience of stigma. We also included the SU-SMS questions [38] to facilitate post-hoc comparison with the newly developed scale. Two quality control items were included as well as a quality check of the inclusion criteria for injection drug use. These three variables were combined and used for sensitivity analysis in the final models.

Statistical analysis. All data management and analyses were conducted in SAS Version 9.4 [68] or Mplus Version 8.3 [69]. Continuous data are described using means and standard deviations, and categorical data are described using frequencies and valid percentages. Missing data, while minimal, was dealt with as appropriate for specific techniques, and included defaults of pairwise deletion or full information maximum likelihood (FIML) methods.

Item refinement. Stigma scale items went through a multi-dimensional refinement process prior to factor analysis on the development dataset. This approach was taken in response to i) a goal of eliminating unreliable or confusing items, and ii) an *a priori* desire to present a refined, quick screening tool of approximately 12–16 items. To be included in the final scale, each item was required to meet a series of three criteria: 1) Cronbach's alpha for each item greater than or equal to 0.50, representing an acceptable degree of internal consistency; 2) a single factor Confirmatory Factor Analysis (CFA) beta greater than or equal to 0.60, indicating a moderate to strong relationship between the variable and the overall stigma construct assessed by the scale (i.e., the latent factor); and 3) items aligning with a three factor CFA based on stigma setting, wherein items coded by experts as having a stigma setting of "healthcare," "society," or "family" fell on their appropriate factors greater than or equal to 0.65. All CFAs were conducted on the polychoric correlations, given the ordinal nature of the items, using FIML method and setting the variances of the latent variables to 1.

Measurement CFA. Next, a series of CFA models were run first on the development sample (County A) and then the validation sample (County B). All CFAs were conducted on the polychoric correlations, given the ordinal nature of the items, using FIML method and setting the variances of the latent variables to 1. Models included 1) a single factor CFA of all items allowing stigma target errors to correlate, 2) a modified single factor CFA of all items and adding another error correlation, 3) three-factor CFA based on stigma setting (factors: healthcare, society, family) allowing latent factors to correlate. A final model was selected based on smallest Akaike information criterion (AIC) and model fit criteria that either were better or did not significantly decrease model fit (e.g., Root mean square error of approximation (RMSEA; preferred < 0.08), standardized root mean squared residual (SRMR; closer to 0 preferred), goodness-of-fit index (GFI; closer to 1 preferred), and Bentler-Bonett normed fit index (NNFI; closer to 1 preferred). Factor loadings for each model are given for the intercepts and slopes, and correlations for the errors allowed to correlate. Only the best fitting model is presented for the development and validation samples.

Validation. Two path analysis models (development, validation) were conducted to test criterion-related concurrent validation. These examined the average of the final set of items as correlated against similar stigma scales [38,40,67] and against a single item question of whether the individual did not seek healthcare even if they needed it (yes, no). The latter was included to evaluate the extent to which the full-scale score corresponds to a primary behavior of interest (healthcare avoidance), which previous literature suggests is strongly associated with drug-related stigma [4,6,7,18–21]. The models

were adjusted for demographics that were hypothesized to be related to healthcare seeking behavior including gender and age. As the model had a binary outcome, a weighted least square estimator was used. Model fit criteria included RMSEA (preferred < 0.08), SRMR (closer to 0 preferred), and Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI; preferred > 0.90). Factor loadings are presented for each item, and the loading against the binary outcome was exponentiated and presented as an odds ratio.

Sensitivity analysis. The final measurement model is presented for the combined sample of those from both development and validation groups who passed all three quality control measures to ensure that our model fit was appropriate against the most stringent sample.

Results

Participants in the formative qualitative interviews (N = 27) and focus groups (N = 28) were majority female (59%) with a median age of 37 years and all but one (96%) were non-Hispanic White. Demographics of the survey participants, by group and as a total sample, are presented in Table 1. Across both samples there were 336 participants (development n = 216; validation n = 120). The majority of both samples were male (60% and 70% respectively) and were on average near 40 years of age. Similar to the qualitative sample, race and ethnicity characteristics were consistent with West Virginia's state demographics: most participants were White (87% and 88%) and non-Hispanic (93% and 94%). Many of the participants reported experiencing homelessness (87% and 82%) and having Medicaid insurance (80% and 77%). Most participants in the development sample reported needing healthcare but not seeking it within the past 6 months (n = 140, 70%) compared to only about half of the validation sample (n = 57, 49%).

Item refinement

The development sample was used for initial item refinement. Table 2 includes all item questions, the source of each question, along with alignment to our definition including stigma type and intervention target. Sequentially working through the criteria for inclusion, 27 of the original 39 items met criteria 1 (internal reliability Cronbach alpha of 0.50 or greater). Next, a single factor CFA resulted in 22 items meeting the criteria of a beta of 0.55 or greater (criteria 2). The final criteria (criteria 3) examined a three-factor CFA of stigma setting (healthcare, society, and family). A total of 16 of the remaining 20 items met the inclusion criteria of a beta of 0.65 or greater. The final numbering of the items corresponds to intervention targets: Items 1–9 all target healthcare, items 10–13 society, and items 14–16 target the family (see Supporting Information S1 Appendix).

Measurement CFA

Next, the 16 DUSS items were included in a series of CFAs in which a single factor solution was included, paying particular attention to error correlations (by intervention target, and then a modification of the best fitting set or error terms). A three-factor solution plus modification were also used against intervention target. The best fitting model was a single factor solution allowing the errors of intervention target items to correlate with each other (all healthcare items were allowed to correlate, all society, and then all family) with an additional single error correlation allowed between two enacted society and family items [13 and 16]. Both development and validation sample results are included in Table 3, along with descriptive information about the scale and Cronbach's alpha. For both models, means fell close to 4 on the 5-point scale (Ms = 3.78, 3.50) and Cronbach's alpha were excellent (0.93, 0.95).

Although both chi-squares were significant (expected given sample sizes) other model fit indicators ranged from good to excellent for both samples. For the development sample, fit statistics were all excellent, including SRMR: 0.03 and RMSEA: 0.09, both close to 0, and GFI: 0.92, CFI: 0.96, NFI: 0.94 all close to 1. Fit attenuated but remained satisfactory for the validation sample, with the GFI and RMSEA deviating from excellent fit (GFI: 0.84, RMSEA: 0.15), all other fit indicators remained excellent (SRMR: 0.05, CFI: 0.92, NFI: 0.90).

Table 1. Demographics for Development (n = 216), Validation (n = 120), and Total Sample (n = 336).

	Development Sample (n = 216)		Validation Sample (n = 120)		Total Sample (n = 336)	
Categorical Variable	***n***	***valid %***	***n***	***valid %***	***n***	***valid %***
Gender						
Male	129	60	83	69.8	212	63.5
Female	82	38.1	35	29.4	117	35
Nonbinary/Other/Refuse	4	1.9	1	0.84	5	1.5
Race						
White	187	87	105	88.2	292	87.4
Black or African American	13	6.1	4	3.4	17	5.1
All other/Refuse	15	7	10	8.4	25	7.5
Ethnicity						
Non-Hispanic	199	92.6	112	94.1	311	93.1
Hispanic/Latino	12	5.6	5	4.2	17	5.1
Don't know/Refuse	4	1.9	2	1.7	6	1.8
Education						
Less than HS	42	19.5	33	27.7	75	22.5
HS or GED	100	46.5	54	45.4	154	46.1
Some college	66	30.7	30	25.2	96	28.7
College or higher	4	1.9	2	1.7	6	1.8
Don't know/Refuse	3	1.4	0	0	3	0.9
Current homeless/unstable housing						
Yes	172	87.3	89	82.4	261	85.6
No	21	10.7	19	17.6	40	13.1
Don't know	4	2	0	0	4	1.3
Insurance						
None	19	8.8	9	7.5	28	8.4
Medicaid	171	79.5	91	76.5	262	78.4
Medicare	18	8.37	13	10.9	31	9.3
Other/Don't know	7	3.3	6	5	13	3.9
Employment						
Full-time	13	6.1	8	6.7	21	6.3
Part-time/ Sometimes	50	23.3	37	31.1	87	26.1
Disability	24	11.2	13	10.9	37	11.1
Unemployed	122	56.7	58	48.7	180	53.9
Other/Don't know/Refuse	6	2.8	3	2.5	9	2.7
Drugs injected past 6 months (check all)						
Heroin	163	75.5	74	61.7	237	70.5
Fentanyl	166	76.9	85	70.8	251	74.7
Cocaine	76	35.2	30	25	106	31.6
Methamphetamine	166	76.9	88	73.3	254	75.6
Suboxone or other prescription opioid	32	14.8	20	16.7	52	15.5
Injection frequency past 6 months						
More than once a day	177	84.7	79	69.3	256	79.3
Once a day	12	5.7	3	2.6	15	4.6
2-6 days a week	11	5.3	19	16.7	30	9.3

(Continued)

Table 1. (Continued)

	Development Sample (n = 216)			Validation Sample (n = 120)			Total Sample (n = 336)		
Categorical Variable	***n***	***valid %***		***n***	***valid %***		***n***	***valid %***	
One day a week	4	1.9		3	2.6		7	2.2	
Less than once a week	2	1		8	7		10	3.1	
Don't know/Refuse	3	1.4		2	1.8		5	1.6	
Ever been in drug treatment									
No	52	24.2		41	34.5		83	24.9	
Yes	161	74.9		78	65.6		249	74.6	
Don't know/Refuse	2	0.9		0	0		2	0.6	
Needed healthcare but did not seek it									
Yes	140	69.7		57	49.1		197	62.2	
No	61	30.4		59	50.9		120	37.9	
Continuous Variables	***Mean (SD)***	***Median***	***25th, 75th***	***Mean (SD)***	***Median***	***25th, 75th***	***Mean (SD)***	***Median***	***25th, 75th***
Years since first injection									
Years	18.1 (10.9)	17	10, 25	16.7 (11.2)	14	8, 23	17.6 (11.0)	17	9, 25
Age									
Years	40.8 (9.1)	40	33.5, 47	39.5 (9.9)	39	32, 44	40.3 (9.4)	39	33, 46

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An examination of the specific item fit shows all items significantly related to the single factor. All standardized estimates were above 0.50 with most being above 0.61 across both samples, suggesting items can be used in conjunction with each other to assess our definition of stigma.

Validation

Next, we examined our average scale scores as correlated with several related stigma scales and against the outcome of not seeking healthcare adjusting for full-time employment and gender (Table 4). Model fit for both the development and validation samples ranged from satisfactory to excellent. Both chi-squares were not statistically significant ($p = 0.15$, 0.06) as preferred. RMSEA were excellent (0.05, 0.08) and close to 0 as were the SRMR (0.05, 0.07). CFI were excellent for both models (0.98, 0.93). TLI was excellent for the development sample (0.95) but dropped slightly for the validation sample (0.84).

For both models, the DUSS scores were significantly associated with increased odds of not seeking healthcare when needed (OR: 1.47, $p = 0.001$; OR: 1.61, $p < 0.0001$) after controlling for gender and age. Age was not associated with healthcare seeking, and male gender (as compared to all other genders) was only associated with healthcare seeking in the development sample.

The DUSS scores were also significantly associated with the other stigma scales. Specifically, scores were highly correlated with the Fong stigma scale [40] (Est: 0.58, 0.78), Smith stigma scale [38] (Est: 0.41, 0.74), and the HIV stigma scale [67] to a lesser degree, as anticipated (Est. 0.20, 0.34), all $p < 0.0001$.

Sensitivity analysis

We combined our samples with only those who passed all three quality control questions with the correct answers and re-ran our single factor measurement CFA to ensure the model fit remained good-to-excellent. For this sample ($n = 216$) model fit remained excellent: SRMR and RMSEA both close to 0 (SRMR: 0.04, RMSEA: 0.09), and CFI, NFI, and GFI all near 1 (GFI: 0.92, NFI: 0.94, CFI: 0.96).

Table 2. Item refinement using Development Sample n = 216.

Item Question	Source	Stigma Type	Stigma Setting	Criteria 1. Alpha ≥ 0.5	Criteria 2. Single factor CFA beta ≥ 0.60	Criteria 3. Stigma based on setting beta ≥ 0.65		
						Healthcare	Society	Family
Healthcare workers have said critical or insulting things about my drug use	Fong 2021	Enacted	Healthcare	0.49				
I have been treated disrespectfully by healthcare workers because of my drug use	Adapted from Fong 2021	Enacted	Healthcare	0.56	0.69	0.74	0.00	0.00
If I was in recovery and relapsed, healthcare workers would criticize me for not trying harder	Adapted from Fong 2021	Anticipated	Healthcare	0.54	0.60	0.63	0.00	0.00
I do not feel welcome in medical care settings	Fong 2021	Enacted	Healthcare	0.58	0.73	0.79	0.00	0.00
When I go for medical care, I try to hide my drug use	Adapted from Fong 2021	Internalized or anticipated	Self, Healthcare	0.48				
When I go for medical care, I am embarrassed or ashamed about being a drug user	Adapted from Fong 2021	Internalized	Self, Healthcare	0.57	0.60	0.56	0.00	0.00
I do not want to disclose my drug use to healthcare workers	Fong 2021	Internalized or anticipated	Self, Healthcare	0.54	0.61	0.61	0.00	0.00
I have been observed more closely than other patients in medical care settings because of my drug use	NEW	Enacted	Healthcare	0.63	0.75	0.78	0.00	0.00
I have been ignored by healthcare workers once they learn or suspect that I use drugs	NEW	Enacted	Healthcare	0.72	0.83	0.86	0.00	0.00
People who are known or suspected to use drugs are "red flagged" in the healthcare system	NEW	Enacted	Healthcare	0.63	0.79	0.82	0.00	0.00
I avoid engaging in healthcare services related to my drug use because I might see someone I know	NEW	Internalized or anticipated	Healthcare	0.52	0.52			
I am treated like a criminal in medical care settings because I use drugs	NEW	Enacted	Healthcare	0.72	0.86	0.89	0.00	0.00
Healthcare workers have thought that I'm pill shopping or trying to con them into giving me prescription medications to get high or sell	Smith 2016	Enacted	Healthcare	0.63	0.74	0.74	0.00	0.00
Healthcare workers have given me poor care because I use drugs	Smith 2016	Enacted	Healthcare	0.66	0.82	0.85	0.00	0.00
I have avoided getting health care because I expect I will be treated badly by healthcare workers	NEW	Anticipated	Healthcare	0.70	0.81	0.81	0.00	0.00
I am comfortable advocating for myself in healthcare settings*	NEW	Internalized	Healthcare	0.03				
I have been threatened with physical harm because of my drug use	Adapted from Patel 2021	Enacted	Society	0.46				
My family has cut off contact with me because of my drug use	Adapted from Patel 2021	Enacted	Family	0.48				

(Continued)

Table 2. (Continued)

Item Question	Source	Stigma Type	Stigma Setting	Criteria 1. Alpha ≥ 0.5	Criteria 2. Single factor CFA beta ≥ 0.60	Criteria 3. Stigma based on setting beta ≥ 0.65		
						Healthcare	Society	Family
I will always be judged for my drug use even if I stop using drugs	NEW	Anticipated	Self, Society	0.59	0.72	0.00	0.76	0.00
I am treated like a criminal by family members because of my drug use	NEW	Enacted	Family	0.48				
I have been denied or lost housing because of my drug use	Adapted from Patel 2021	Enacted	Society	0.55	0.54			
People who experience homelessness are automatically assumed to be using drugs	NEW	Anticipated or enacted	Self, Society	0.61	0.71	0.00	0.84	0.00
I have been denied or lost a job because of my drug use	NEW	Enacted	Society	0.51	0.52			
I am treated like a criminal by society for using drugs	NEW	Enacted	Self, Society	0.67	0.77	0.00	0.89	0.00
I am watched more closely than other people in public places because of my drug use	NEW	Enacted	Society	0.58	0.68	0.00	0.73	0.00
I hide my drug use when interacting with my family	NEW	Internalized or anticipated	Family	0.57	0.60	0.00	0.00	0.67
I hide my drug use when out in the community	NEW	Internalized or anticipated	Self, Society	0.54	0.59	0.00	0.58	0.00
I avoid services related to drug use because my family might find out that I use drugs	NEW	Anticipated	Family	0.51	0.46			
I avoid my family because of my drug use	NEW	Internalized or anticipated	Family	0.58	0.59	0.00	0.00	0.69
I hide my drug use because it would bring embarrassment or shame to my family	NEW	Anticipated	Family	0.57	0.57			
Family members do not trust me because of my drug use	Adapted from Smith 2016	Enacted	Family	0.52	0.56			
Family members look down on me because of my drug use	Adapted from Smith 2016	Enacted	Family	0.58	0.64	0.00	0.00	0.75
I am most comfortable with myself when I am around other people who use drugs*	NEW	Internalized	Society	0.48				
Mutual help meetings (like NA or AA) are not welcoming to people who are currently using drugs	NEW	Anticipated or enacted	Drug treatment/recovery, Family	0.34				
Family members of people who use drugs disapprove of medications for opioid use disorder (like methadone or buprenorphine)	NEW	Anticipated or enacted	Drug treatment/recovery, Family	0.43				

(Continued)

Table 2. (Continued)

Item Question	Source	Stigma Type	Stigma Setting	Criteria 1. Alpha ≥ 0.5	Criteria 2. Single factor CFA beta ≥ 0.60	Criteria 3. Stigma based on setting beta ≥ 0.65		
						Healthcare	Society	Family
Healthcare workers disapprove of people who use medication for opioid use disorder (like methadone or buprenorphine)	NEW	Anticipated or enacted	Drug treatment/recovery, Healthcare	0.48				
The recovery community disapproves of people who use medications for opioid use disorder (like methadone or buprenorphine)	NEW	Anticipated or enacted	Drug treatment/recovery	0.39				
Society disapproves of people who use medications for opioid use disorder (like methadone or buprenorphine)	NEW	Anticipated or enacted	Drug treatment/recovery, Society	0.51	0.52			
I am concerned about being shamed by others for using medications for opioid use disorder (like methadone or buprenorphine)	NEW	Anticipated	Drug treatment/recovery	0.39				

*indicates reverse coded item; items in bold font retained in final scale.

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Discussion

Drug-related stigma contributes to adverse health experiences and barriers to healthcare engagement among people who use drugs. Efforts to develop and evaluate interventions designed to reduce this stigma require valid stigma measurement instruments that can be applied across different stigma types, settings, and user groups.

In this study, we used both qualitative and quantitative methods to develop a new instrument, the DUSS, for assessing drug-related stigma among PWID. The instrument was developed and tested with participants from two rural samples and demonstrated high structural validity and internal reliability across multiple drug stigma mechanisms (anticipated, enacted, internalized) and settings (healthcare, family, society). This 16-item scale has several strengths to recommend its use over existing drug-related stigma scales.

First, our sample consisted of community recruited PWID. Some prior efforts have used treatment-based samples to facilitate study recruitment [2,35,36,38,70], but only a small percentage of people with substance use disorder actually receive treatment [71]. Accordingly, it is highly unlikely that scales developed using treatment-based samples are broadly generalizable to drug using populations. This is especially true in the context of stigma, which itself can serve as a barrier to treatment engagement [5,72].

Second, the DUSS was developed with input from, and in samples exclusive to, PWID. As noted, injection drug use is more highly stigmatized than other forms of drug use [1,2] and there is a growing literature specific to the experiences and impacts of stigma in PWID communities (e.g., 3, 4, 6, 7, 10, 11, 15, 18–21). Prior efforts among PWID were limited to non-U.S. based samples [8,41] or, for those conducted in the U.S., limited to stigma in healthcare settings [40]. The DUSS provides a tool for assessing stigma for U.S.-based PWID across multiple settings where stigma may be encountered. That said, we took care in drafting the wording of the scale items to ensure they could be easily applied to populations that use drugs by non-injection routes. Future studies should test the validity and reliability of the DUSS in these populations.

Third, our study is the first to validate a drug-related stigma scale in rural communities. While rural injection drug use, and drug use more broadly, has increased substantially in recent years, none of the existing stigma scales were developed or validated in rural populations. There is ample evidence to suggest that drug-related stigma persists in rural areas [58,59,73,74] and that people who use drugs in rural areas may encounter higher levels of stigma than those in urban

Table 3. Single factor CFA for development (n = 207) and Validation (n = 115) Samples, Allowing Correlated Errors by Intervention Target.

	Development Sample (n = 207)						Validation sample (n = 115)					
Descriptive Statistics												
DUSS mean (SD)	3.78 (0.82)						3.50 (0.98)					
Scale Cronbach's alpha	0.93						0.95					
Fit Summary												
Fit Function	0.73						1.81					
Chi-Square	149.80						206.67					
Chi-Square DF	58						58					
Pr > Chi-Square	<.0001						<.0001					
SRMR	0.03						0.05					
GFI	0.92						0.84					
RMSEA (90% CL)	0.09	(0.07, 0.11)					0.15	(0.13, 0.17)				
Akaike Information Criterion	305.80						362.67					
CFI	0.96						0.92					
Bentler-Bonett NFI	0.94						0.90					
Items	***Unstandardized Estimate***	***SE***	***t Value***	***p-value***	***R-Square***	***Standardized Estimate***	***Unstandardized Estimate***	***SE***	***t Value***	***p-value***	***R-Square***	***Standardized Estimate***
1. I have been treated disrespectfully by healthcare workers because of my drug use	0.82	0.10	8.29	<.0001	0.33	0.57	0.89	0.12	7.60	<.0001	0.42	0.64
2. I do not feel welcome in medical care settings	0.76	0.08	8.96	<.0001	0.37	0.61	0.76	0.11	6.82	<.0001	0.35	0.59
3. I have been observed more closely than other patients in medical care settings because of my drug use	0.77	0.08	9.21	<.0001	0.39	0.63	0.83	0.12	7.18	<.0001	0.38	0.61
4. I have been ignored by healthcare workers once they learn or suspect that I use drugs	0.89	0.08	11.35	<.0001	0.54	0.73	0.96	0.11	8.79	<.0001	0.52	0.72
5. People who are known or suspected to use drugs are "red flagged" in the healthcare system	0.84	0.08	10.68	<.0001	0.49	0.70	1.03	0.11	9.54	<.0001	0.59	0.77
6. I am treated like a criminal in medical care settings because I use drugs	0.90	0.08	11.94	<.0001	0.58	0.76	0.95	0.11	9.01	<.0001	0.54	0.74
7. Healthcare workers have thought that I'm pill shopping or trying to con them into giving me prescription medications to get high or sell	0.82	0.08	9.86	<.0001	0.44	0.66	0.99	0.11	8.75	<.0001	0.52	0.72
8. Healthcare workers have given me poor care because I use drugs	0.91	0.08	11.90	<.0001	0.58	0.76	0.97	0.11	8.82	<.0001	0.52	0.72
9. I have avoided getting health care because I expect I will be treated badly by healthcare workers	0.87	0.07	11.71	<.0001	0.56	0.75	0.86	0.11	7.83	<.0001	0.44	0.66
10. I will always be judged for my drug use even if I stop using drugs	0.81	0.07	11.97	<.0001	0.59	0.77	1.10	0.11	9.91	<.0001	0.67	0.82

(Continued)

Table 3. (Continued)

	Development Sample (n = 207)						Validation sample (n = 115)					
11. People who experience homelessness are automatically assumed to be using drugs	0.85	0.07	11.67	<.0001	0.57	0.76	1.00	0.10	10.46	<.0001	0.71	0.85
12. I am treated like a criminal by society for using drugs	0.84	0.06	13.02	<.0001	0.66	0.82	1.21	0.10	12.64	<.0001	0.88	0.94
13. I am watched more closely than other people in public places because of my drug use	0.70	0.06	10.93	<.0001	0.52	0.72	0.95	0.10	9.56	<.0001	0.64	0.80
14. I hide my drug use when interacting with my family	0.66	0.08	8.26	<.0001	0.32	0.56	0.89	0.10	8.95	<.0001	0.54	0.73
15. I avoid my family because of my drug use	0.67	0.08	8.30	<.0001	0.32	0.56	0.79	0.12	6.85	<.0001	0.35	0.59
16. Family members look down on me because of my drug use	0.66	0.06	10.49	<.0001	0.46	0.68	0.89	0.10	9.09	<.0001	0.55	0.74

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areas [60,75]. Our formative qualitative work on this project elicited multiple comments regarding the challenges in maintaining anonymity as a person who uses drugs in small town settings compared to those in urban areas. Although our goal was to develop a scale that is relevant to the experiences of rural PWID, future studies should test the validity of the DUSS in both urban and suburban settings.

Fourth, the DUSS was developed with direct input from PWID, in contrast to efforts that have relied solely on literature review, theory, and/or researcher knowledge and expertise. As shown in Table 2, our qualitative work with PWID contributed several "new" questions to the scale that would have been missed had we only sought to validate existing stigma scales; indeed 11 of the items in our validated 16-item scale are "new" items that emerged from our qualitative work. These new items spanned multiple settings (healthcare, society/self, and family) and types of stigma (enacted, anticipated, internalized), emphasizing the breadth and depth of stigma experienced by PWID in their daily lives. Our reliance on the lived experience of PWID in developing our scale is consistent with more recent efforts to involve PWID in research and policy development that affects their lives and ensures that the DUSS captures those aspects of stigma that are most salient to this population.

It is important to note that our scale development and validation strategy prioritized qualitative findings over strict adherence to ensuring equal representation across various stigma domains (internalized, enacted, anticipated). Indeed, we found over the course of the study that many of the scale items developed during the qualitative phase did not fit neatly within a single stigma domain, which is perhaps not surprising given that these domains are theoretical. Again, we view this approach to item creation based on PWID's lived experiences and input as a strength and note that the final validated scale still includes at least one item from each of three stigma domains.

Finally, the DUSS provides a scale that can be used to assess stigma across multiple settings. Unlike previous scales, this new scale addresses a broader range of settings (health care, family, society) corresponding to the lived experience of PWID. Our hope is that this will facilitate not just understanding of the nature of stigma experienced by PWID in each of these settings but prioritization of those settings where stigma reduction interventions are most warranted.

Our study does have limitations. The DUSS was developed based on data from PWID in a single rural state with limited racial and ethnic diversity and high levels (>80%) of homelessness and unstable housing. While we view the rural focus as filling an important gap in the literature, future studies should examine the validity of the scale in suburban and urban communities and more racially and ethnically diverse populations as well as other rural settings. Similarly, while we view our focus on PWID as a strength, future studies should examine the validity of the DUSS in other drug using populations.

Table 4. Validation path analysis against related stigma scales and seeing healthcare for the DUSS development (n = 207) and validation samples (n = 120), adjusted for gender and age.

		Development Sample (n = 207)				Validation sample (n = 120)			
Descriptive statistics		***N***	***M***	***SD***		***N***	***M***	***SD***	
Smith stigma scale		208	3.5	0.8		117	3.2	1	
HIV stigma scale		175	2.9	0.7		116	2.7	0.8	
Fong stigma scale		213	3.5	1		119	3.3	1	
Fit summary		***Estimate***				***Estimate***			
Chi-Square		13.30				16.50			
Chi-square df		9				9			
Chi-square p-value		0.1494				0.0572			
RMSEA		0.05				0.08			
RMSEA 90% CL		0.000, 0.097				0.000, 0.146			
RMSEA p-value ≤ 0.05		0.48				0.17			
CFI		0.98				0.93			
TLI		0.95				0.84			
SRMR		0.05				0.07			
Model Results									
Dependent Variable	***Independent Variable***	***Estimate***	***S.E.***	***P-Value***	***OR***	***Estimate***	***S.E.***	***P-Value***	***OR***
Did not seek healthcare									
	NEW	0.39	0.11	0.001	1.47	0.48	0.11	<0.0001	1.61
	Male gender	−0.44	0.19	0.02	0.64	0.16	0.25	0.521	1.17
	Age	0.01	0.01	0.572	1.01	0.00	0.01	0.955	1.00
Correlations		***Estimate***	***S.E.***	***P-Value***		***Estimate***	***S.E.***	***P-Value***	
NEW	Smith stigma scale	0.41	0.06	<0.0001		0.74	0.12	<0.0001	
NEW	HIV stigma scale	0.20	0.04	<0.0001		0.34	0.07	<0.0001	
NEW	Fong stigma scale	0.58	0.07	<0.0001		0.78	0.14	<0.0001	
NEW	Age	−0.36	0.49	0.458		−1.75	0.96	0.07	
NEW	Male gender	0.00	0.02	0.881		−0.01	0.04	0.822	
Smith stigma scale	HIV stigma scale	0.31	0.04	<0.0001		0.29	0.06	<0.0001	
Smith stigma scale	Fong stigma scale	0.30	0.06	<0.0001		0.60	0.12	<0.0001	
HIV stigma scale	Fong stigma scale	0.16	0.04	<0.0001		0.31	0.07	<0.0001	
Male gender	Age	0.59	0.31	0.06		0.80	0.43	0.067	

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Conclusions

This study developed and validated a new drug-related stigma scale, the DUSS, that has several benefits over previously developed scales for assessing stigma among community based rural PWID. Although research is needed to test the validity of the scale in other settings and drug using populations, the DUSS provides a valuable tool for characterizing the nature and extent of stigma experienced by PWID and informing the development and testing of interventions designed to mitigate the impacts of drug-related stigma on their health and wellbeing.

Supporting information

S1 Appendix. Drug Use Stigma Scale (DUSS) Instrument and Scoring Instructions.
(DOCX)

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References

1. Etesam F, Assarian F, Hosseini H, Ghoreishi FS. Stigma and its determinants among male drug dependents receiving methadone maintenance treatment. Arch Iran Med. 2014;17(2):108–14. PMID: 24527971
2. Luoma JB, Twohig MP, Waltz T, Hayes SC, Roget N, Padilla M, et al. An investigation of stigma in individuals receiving treatment for substance abuse. Addict Behav. 2007;32(7):1331–46. https://doi.org/10.1016/j.addbeh.2006.09.008 PMID: 17092656
3. Muncan B, Walters SM, Ezell J, Ompad DC. They look at us like junkies: influences of drug use stigma on the healthcare engagement of people who inject drugs in New York City. Harm Reduct J. 2020;17(1).
4. Biancarelli DL, Biello KB, Childs E, Drainoni M, Salhaney P, Edeza A, et al. Strategies used by people who inject drugs to avoid stigma in healthcare settings. Drug Alcohol Depend. 2019;198:80–6. https://doi.org/10.1016/j.drugalcdep.2019.01.037 PMID: 30884432
5. Hammarlund R, Crapanzano KA, Luce L, Mulligan L, Ward KM. Review of the effects of self-stigma and perceived social stigma on the treatment-seeking decisions of individuals with drug- and alcohol-use disorders. Subst Abuse Rehabil. 2018;9:115–36. https://doi.org/10.2147/SAR.S183256 PMID: 30538599
6. Miller-Lloyd L, Landry J, Macmadu A, Allard I, Waxman M. Barriers to healthcare for people who inject drugs: a survey at a syringe exchange program. Subst Use Misuse. 2020;55(6):896–9. https://doi.org/10.1080/10826084.2019.1710207 PMID: 31902293
7. Paquette CE, Syvertsen JL, Pollini RA. Stigma at every turn: health services experiences among people who inject drugs. Int J Drug Policy. 2018;57:104–10. https://doi.org/10.1016/j.drugpo.2018.04.004 PMID: 29715589
8. Latkin C, Srikrishnan AK, Yang C, Johnson S, Solomon SS, Kumar S, et al. The relationship between drug use stigma and HIV injection risk behaviors among injection drug users in Chennai, India. Drug Alcohol Depend. 2010;110(3):221–7. https://doi.org/10.1016/j.drugalcdep.2010.03.004 PMID: 20462707
9. Latkin CA, Gicquelais RE, Clyde C, Dayton L, Davey-Rothwell M, German D, et al. Stigma and drug use settings as correlates of self-reported, non-fatal overdose among people who use drugs in Baltimore, Maryland. Int J Drug Policy. 2019;68:86–92. https://doi.org/10.1016/j.drugpo.2019.03.012 PMID: 31026734
10. Couto E Cruz C, Salom CL, Dietze P, Lenton S, Burns L, Alati R. Frequent experience of discrimination among people who inject drugs: Links with health and wellbeing. Drug Alcohol Depend. 2018;190:188–94. https://doi.org/10.1016/j.drugalcdep.2018.06.009 PMID: 30048872
11. von Hippel C, Brener L, Horwitz R. Implicit and explicit internalized stigma: relationship with risky behaviors, psychosocial functioning and healthcare access among people who inject drugs. Addict Behav. 2018;76:305–11. https://doi.org/10.1016/j.addbeh.2017.08.036 PMID: 28889059
12. Deryabina A, El-Sadr WM. Uptake of needle and syringe program services in the Kyrgyz Republic: Key barriers and facilitators. Drug Alcohol Depend. 2017;179:180–6. https://doi.org/10.1016/j.drugalcdep.2017.07.002 PMID: 28787695

13. Rivera AV, De Cuir J, Crawford ND, Amesty S, Lewis CF. Internalized stigma and sterile syringe use among people who inject drugs in New York City, 2010–2012. Drug and Alcohol Dependence. 2014;144:259–64.
14. Davidson PJ, Lozada R, Rosen PC, Macias A, Gallardo M, Pollini RA. Negotiating access: social barriers to purchasing syringes at pharmacies in Tijuana, Mexico. Int J Drug Policy. 2012;23(4):286–94. https://doi.org/10.1016/j.drugpo.2012.05.001 PMID: 22676968
15. Meyerson BE, Lawrence CA, Cope SD, Levin S, Thomas C, Eldridge LA. I could take the judgment if you could just provide the service: Non-prescription syringe purchase experience at Arizona pharmacies, 2018. Harm Reduct J. 2019;16(1).
16. Ibragimov U, Cooper HL, Haardörfer R, Dunkle KL, Zule WA, Wong FY. Stigmatization of people who inject drugs (PWID) by pharmacists in Tajikistan: sociocultural context and implications for a pharmacy-based prevention approach. Harm Reduct J. 2017;14(1):64. https://doi.org/10.1186/s12954-017-0190-x PMID: 28915888
17. Ghaddar A, Nassar K, Elsoury G. Barriers to access to sterile syringes as perceived by pharmacists and injecting drug users: implications for harm reduction in Lebanon. Subst Use Misuse. 2017;52(11):1420–8. https://doi.org/10.1080/10826084.2017.1284235 PMID: 28430013
18. Harris RE, Richardson J, Frasso R, Anderson ED. Experiences with skin and soft tissue infections among people who inject drugs in Philadelphia: a qualitative study. Drug Alcohol Depend. 2018;187:8–12. https://doi.org/10.1016/j.drugalcdep.2018.01.029 PMID: 29626746
19. Pollini RA, Paquette CE, Drvar T, Marshalek P, Ang-Rabanes M, Feinberg J, et al. A qualitative assessment of discharge against medical advice among patients hospitalized for injection-related bacterial infections in West Virginia. Int J Drug Policy. 2021;94:103206. https://doi.org/10.1016/j.drugpo.2021.103206 PMID: 33765516
20. Brener L, Cama E, Broady T, Harrod ME, Holly C, Caruana T, et al. Experiences of stigma and subsequent reduced access to health care among women who inject drugs. Drug Alcohol Rev. 2024;43(5):1071–9. https://doi.org/10.1111/dar.13806 PMID: 38271084
21. Meyerson BE, Russell DM, Kichler M, Atkin T, Fox G, Coles HB. I don't even want to go to the doctor when I get sick now: Healthcare experiences and discrimination reported by people who use drugs, Arizona 2019. Int J Drug Policy. 2021;93:103112. https://doi.org/10.1016/j.drugpo.2021.103112 PMID: 33461838
22. Ahern J, Stuber J, Galea S. Stigma, discrimination and the health of illicit drug users. Drug Alcohol Depend. 2007;88(2–3):188–96. https://doi.org/10.1016/j.drugalcdep.2006.10.014 PMID: 17118578
23. Birtel MD, Wood L, Kempa NJ. Stigma and social support in substance abuse: Implications for mental health and well-being. Psychiatry Res. 2017;252:1–8. https://doi.org/10.1016/j.psychres.2017.01.097 PMID: 28237758
24. Latkin C, Davey-Rothwell M, Yang J, Crawford N. The relationship between drug user stigma and depression among inner-city drug users in Baltimore, MD. J Urban Health. 2013;90(1):147–56. https://doi.org/10.1007/s11524-012-9753-z PMID: 22918839
25. Gu J, Lau JTF, Li M, Li H, Gao Q, Feng X, et al. Socio-ecological factors associated with depression, suicidal ideation and suicidal attempt among female injection drug users who are sex workers in China. Drug Alcohol Depend. 2014;144:102–10. https://doi.org/10.1016/j.drugalcdep.2014.08.011 PMID: 25236890
26. Davis RE, Doyle NA, Nahar VK. An investigation of the associations between drug-related self-stigmatizing beliefs, depression, and suicidal ideation among collegiate drug users. J Alcohol and Drug Education. 2020;64(1):52–80.
27. El Hayek S, Foad W, de Filippis R, Ghosh A, Koukach N, Mahgoub Mohammed Khier A, et al. Stigma toward substance use disorders: a multinational perspective and call for action. Front Psychiatry. 2024;15:1295818. https://doi.org/10.3389/fpsyt.2024.1295818 PMID: 38362033
28. McGinty EE, Barry CL. Stigma Reduction to Combat the Addiction Crisis - Developing an Evidence Base. N Engl J Med. 2020;382(14):1291–2. https://doi.org/10.1056/NEJMp2000227 PMID: 32242352
29. Volkow ND. Stigma and the toll of addiction. N Engl J Med. 2020;382(14):1289–90. https://doi.org/10.1056/NEJMp1917360 PMID: 32242351
30. Goffman E. Stigma; notes on the management of spoiled identity. Englewood Cliffs, NJ: Prentice-Hall. 1963.
31. Kulesza M, Larimer ME, Rao D. Substance use related stigma: what we know and the way forward. J Addict Behav Ther Rehabil. 2013;2(2):782. https://doi.org/10.4172/2324-9005.1000106 PMID: 25401117
32. Spata A, Gupta I, Lear MK, Lunze K, Luoma JB. Substance use stigma: A systematic review of measures and their psychometric properties. Drug Alcohol Depend Rep. 2024;11:100237. https://doi.org/10.1016/j.dadr.2024.100237 PMID: 38779475
33. Earnshaw VA, Smith LR, Chaudoir SR, Amico KR, Copenhaver MM. HIV stigma mechanisms and well-being among PLWH: a test of the HIV stigma framework. AIDS Behav. 2013;17(5):1785–95. https://doi.org/10.1007/s10461-013-0437-9 PMID: 23456594
34. Earnshaw VA, Chaudoir SR. From conceptualizing to measuring HIV stigma: a review of HIV stigma mechanism measures. AIDS Behav. 2009;13(6):1160–77. https://doi.org/10.1007/s10461-009-9593-3 PMID: 19636699
35. Luoma JB, O'Hair AK, Kohlenberg BS, Hayes SC, Fletcher L. The development and psychometric properties of a new measure of perceived stigma toward substance users. Subst Use Misuse. 2010;45(1–2):47–57. https://doi.org/10.3109/10826080902864712 PMID: 20025438
36. Luoma JB, Nobles RH, Drake CE, Hayes SC, O'Hair A, Fletcher L, et al. Self-Stigma in Substance Abuse: Development of a New Measure. J Psychopathol Behav Assess. 2013;35(2):223–34. https://doi.org/10.1007/s10862-012-9323-4 PMID: 23772099
37. Yang LH, Grivel MM, Anderson B, Bailey GL, Opler M, Wong LY, et al. A new brief opioid stigma scale to assess perceived public attitudes and internalized stigma: evidence for construct validity. J Subst Abuse Treat. 2019;99:44–51. https://doi.org/10.1016/j.jsat.2019.01.005 PMID: 30797393

38. Smith LR, Earnshaw VA, Copenhaver MM, Cunningham CO. Substance use stigma: reliability and validity of a theory-based scale for substance-using populations. Drug Alcohol Depend. 2016;162:34–43. https://doi.org/10.1016/j.drugalcdep.2016.02.019 PMID: 26972790

39. Bann CM, Newman JE, Okoniewski KC, Clarke L, Wilson-Costello D, Merhar S, et al. Psychometric properties of the prenatal opioid use perceived stigma scale and its use in prenatal care. J Obstet Gynecol Neonatal Nurs. 2023;52(2):150–8. https://doi.org/10.1016/j.jogn.2022.12.002 PMID: 36696952

40. Fong C, Mateu-Gelabert P, Ciervo C, Eckhardt B, Aponte-Melendez Y, Kapadia S, et al. Medical provider stigma experienced by people who use drugs (MPS-PWUD): Development and validation of a scale among people who currently inject drugs in New York City. Drug Alcohol Depend. 2021;221:108589. https://doi.org/10.1016/j.drugalcdep.2021.108589 PMID: 33621804

41. Patel EU, Solomon SS, Lucas GM, McFall AM, Tomori C, Srikrishnan AK, et al. Drug use stigma and its association with active hepatitis C virus infection and injection drug use behaviors among community-based people who inject drugs in India. Int J Drug Policy. 2021;96:103354. https://doi.org/10.1016/j.drugpo.2021.103354 PMID: 34247900

42. King DD, Gill CJ, Cadieux CS, Singh N. The role of stigma in cannabis use disclosure: an exploratory study. Harm Reduct J. 2024;21(1):21. https://doi.org/10.1186/s12954-024-00929-8 PMID: 38273362

43. Wilson L, Karnik N, Wong JY, Barchet L, Sareen J, Jwely A, et al. Perceived need for care and stigma experiences among individuals with methamphetamine-related admissions to inpatient mental health wards. Harm Reduct J. 2023;20(1):104. https://doi.org/10.1186/s12954-023-00827-5 PMID: 37533062

44. Batchelder AW, Foley JD, Wirtz MR, Mayer K, O'Cleirigh C. Substance use stigma, avoidance coping, and missed HIV appointments among MSM who use substances. AIDS Behav. 2021;25(5):1454–63. https://doi.org/10.1007/s10461-020-02982-3 PMID: 32737816

45. Mlunde LB, Hirschhorn LR, Nyblade L, Rothrock NE, Mbugi EV, Moskowitz JT, et al. Translation and cultural adaptation of drug use stigma and HIV stigma measures among people who use drugs in Tanzania. PLoS One. 2023;18(10):e0292642. https://doi.org/10.1371/journal.pone.0292642 PMID: 37856437

46. Kleinman MB, Anvari MS, Felton JW, Bradley VD, Belcher AM, Abidogun TM, et al. Reduction in substance use stigma following a peer-recovery specialist behavioral activation intervention. Int J Drug Policy. 2024;130:104511. https://doi.org/10.1016/j.drugpo.2024.104511 PMID: 39003894

47. Can Gür G, Tanriverdi D, Ariti M, Özgün Öztürk F. The adaptation of the substance use stigma mechanism scale (SU-SMS) into Turkish: a validity and reliability study. J Am Psychiatr Nurses Assoc. 2022;28(4):295–305. https://doi.org/10.1177/1078390320949927 PMID: 32806988

48. Rafful C, López A, Contreras-Valdez JA, Morales M, Jiménez-Rivagorza L, Orozco R. Substance use stigma mechanisms scale: Factor structure, reliability, and validity in Mexican adults that use drugs. Drug Alcohol Depend. 2022;239:109598. https://doi.org/10.1016/j.drugalcdep.2022.109598 PMID: 35961267

49. Wang D, Zhou Y, Chen S, Wu Q, He L, Wang Q, et al. Employing bayesian analysis to establish a cut-off point and assess stigma prevalence in substance use disorder: a comprehensive study of the Chinese version of the substance use stigma mechanism scale. Soc Psychiatry Psychiatr Epidemiol. 2024;59(10):1883–92. https://doi.org/10.1007/s00127-024-02621-5 PMID: 38411725

50. Takano A, Hiraiwa C, Oikawa E, Tomikawa A, Nozawa K. Validity and reliability of the Japanese version of the substance use stigma mechanism scale. PLoS One. 2024;19(10):e0310514. https://doi.org/10.1371/journal.pone.0310514 PMID: 39480854

51. Lerner AM, Fauci AS. Opioid injection in rural areas of the united states: a potential obstacle to ending the HIV epidemic. JAMA. 2019;322(11):1041–2. https://doi.org/10.1001/jama.2019.10657 PMID: 31369035

52. Van Handel MM, Rose CE, Hallisey EJ, Kolling JL, Zibbell JE, Lewis B, et al. County-level vulnerability Assessment for rapid dissemination of HIV or HCV infections among persons who inject drugs, United States. J Acquir Immune Defic Syndr. 2016;73(3):323–31. https://doi.org/10.1097/QAI.0000000000001098 PMID: 27763996

53. Peters PJ, Pontones P, Hoover KW, Patel MR, Galang RR, Shields J. HIV infection linked to injection use of oxymorphone in Indiana, 2014-2015. New England Journal of Medicine. 2016;375(3):229–39.

54. Hershow RB, Wilson S, Bonacci RA, Deutsch-Feldman M, Russell OO, Young S, et al. Notes from the Field: HIV outbreak during the COVID-19 pandemic among persons who inject drugs - Kanawha County, West Virginia, 2019-2021. MMWR Morb Mortal Wkly Rep. 2022;71(2):66–8. https://doi.org/10.15585/mmwr.mm7102a4 PMID: 35025854

55. Nenninger EK, Carwile JL, Ahrens KA, Armstrong B, Thakarar K. Rural-urban differences in hospitalizations for opioid use-associated infective endocarditis in the United States, 2003-2016. Open Forum Infect Dis. 2020;7(2):ofaa045.

56. Agha A, Nazir S, Minhas AMK, Kayani W, Issa R, Moukarbel GV, et al. Demographic and regional trends of infective endocarditis-related mortality in the United States, 1999 to 2019. Curr Probl Cardiol. 2023;48(1):101397. https://doi.org/10.1016/j.cpcardiol.2022.101397 PMID: 36100097

57. Bhandari R, Alexander T, Annie FH, Kaleem U, Irfan A, Balla S, et al. Steep rise in drug use-associated infective endocarditis in West Virginia: characteristics and healthcare utilization. PLoS One. 2022;17(7):e0271510. https://doi.org/10.1371/journal.pone.0271510 PMID: 35839224

58. Surratt HL, Otachi JK, McLouth CJ, Vundi N. Healthcare stigma and HIV risk among rural people who inject drugs. Drug Alcohol Depend. 2021;226:108878. https://doi.org/10.1016/j.drugalcdep.2021.108878 PMID: 34214880

59. Ezell JM, Walters S, Friedman SR, Bolinski R, Jenkins WD, Schneider J, et al. Stigmatize the use, not the user? Attitudes on opioid use, drug injection, treatment, and overdose prevention in rural communities. Soc Sci Med. 2021;268:113470. https://doi.org/10.1016/j.socscimed.2020.113470 PMID: 33253992

60. Franz B, Dhanani LY, Miller WC. Rural-urban differences in physician bias toward patients with opioid use disorder. Psychiatr Serv. 2021;72(8):874–9. https://doi.org/10.1176/appi.ps.202000529 PMID: 33622043
61. Lincoln YS, Guba EG. Naturalistic inquiry. SAGE Publications. 1985.
62. Patton MQ. Qualitative research and evaluation methods. 3rd ed. Thousand Oaks, California: Sage. 2002.
63. Balza JS, Cusatis R, McDonnell SM, Basir MA, Flynn KE. Effective questionnaire design: how to use cognitive interviews to refine questionnaire items. J Neonatal Perinatal Med. 2022;15(2):345–9. https://doi.org/10.3233/NPM-210848 PMID: 35034911
64. Beatty PC, Willis GB. Research synthesis: the practice of cognitive interviewing. Public Opinion Quarterly. 2007;71(2):287–311. https://doi.org/10.1093/poq/nfm006
65. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377–81. https://doi.org/10.1016/j.jbi.2008.08.010 PMID: 18929686
66. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019;95:103208. https://doi.org/10.1016/j.jbi.2019.103208 PMID: 31078660
67. Berger BE, Ferrans CE, Lashley FR. Measuring stigma in people with HIV: psychometric assessment of the HIV stigma scale. Res Nurs Health. 2001;24(6):518–29. https://doi.org/10.1002/nur.10011 PMID: 11746080
68. SAS Institute Inc. SAS 9.4. Cary, NC, USA: SAS Institute Inc. 2023.
69. Muthén, Muthén. Mplus. Los Angeles, CA, USA: Muthén & Muthén.
70. Yang Q, Van Stee SK. The Comparative Effectiveness of Mobile Phone Interventions in Improving Health Outcomes: Meta-Analytic Review. JMIR Mhealth Uhealth. 2019;7(4):e11244. https://doi.org/10.2196/11244 PMID: 30942695
71. SAMHSA. Key substance use and mental health indicators in the United States: Results from the 2023 National Survey On Drug Use And Health. Rockville, MD; 2024.
72. Hall NY, Le L, Majmudar I, Mihalopoulos C. Barriers to accessing opioid substitution treatment for opioid use disorder: A systematic review from the client perspective. Drug Alcohol Depend. 2021;221:108651. https://doi.org/10.1016/j.drugalcdep.2021.108651 PMID: 33667783
73. Burgess A, Bauer E, Gallagher S, Karstens B, Lavoie L, Ahrens K, et al. Experiences of stigma among individuals in recovery from opioid use disorder in a rural setting: a qualitative analysis. J Subst Abuse Treat. 2021;130:108488. https://doi.org/10.1016/j.jsat.2021.108488 PMID: 34118715
74. Baker LS, Smith W, Gulley T, Tomann MM. Community perceptions of comprehensive harm reduction programs and stigma towards people who inject drugs in rural Virginia. J Community Health. 2020;45(2):239–44. https://doi.org/10.1007/s10900-019-00732-8 PMID: 31502098
75. Davis A, Stringer KL, Drainoni M-L, Oser CB, Knudsen HK, Aldrich A, et al. Community-level determinants of stakeholder perceptions of community stigma toward people with opioid use disorders, harm reduction services and treatment in the HEALing communities study. Int J Drug Policy. 2023;122:104241. https://doi.org/10.1016/j.drugpo.2023.104241 PMID: 37890391