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Publication Date

2014-09-01

DOI

10.1016/j.drugalcdep.2014.06.034

Peer reviewed

Published in final edited form as:
Drug Alcohol Depend. 2014 September 1; 0: 254–261. doi:10.1016/j.drugalcdep.2014.06.034.

Effect of a Primary Care based Brief Intervention Trial among Risky Drug Users on Health-related Quality of Life

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Abstract

Background—Improvement in quality of life (QOL) is a long term goal of drug treatment. Although some brief interventions have been found to reduce illicit drug use, no trial among adult risky (moderate non-dependent) drug users has tested effects on health-related quality of life.

Methods—A single-blind randomized controlled trial of patients enrolled from February 2011 to November 2012 was conducted in waiting rooms of five federally qualified health centers. 413 adult primary care patients were identified as risky drug users using the WHO-ASSIST and 334 (81% response; 171 intervention, 163 control) consented to participate in the trial. Three-month follow-ups were completed by 261 patients (78%). Intervention patients received the QUIT intervention of brief clinician advice and up to two drug-use health telephone sessions. The control group received usual care and information on cancer screening. Outcomes were three-month

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Contributions

SB: statistical analysis; drafting of the manuscript. LG, RA: critical revision of the manuscript for important intellectual content, obtained funding, study concept and design; acquisition of data. Ronald M. Andersen: critical revision of the manuscript for important intellectual content, obtained funding, study concept and design; acquisition of data. BL: study concept and design; statistical analysis, study supervision, critical revision of the manuscript. JM, MV: critical revision of the manuscript for important intellectual content. All authors contributed to and have approved the final manuscript.

Conflict of Interest

No conflict declared

changes in the Short Form Health Survey (SF-12) mental health component summary score (MCS) and physical health component summary score (PCS).

Results—The average treatment effect (ATE) was non-significant for MCS (0.2 points, p-value=0.87) and marginally significant for PCS (1.7 points, p-value=0.08). The average treatment effect on the treated (ATT) was 0.1 (p-value=0.93) for MCS and 1.9 (p-value=0.056) for PCS. The effect on PCS was stronger at higher (above median) baseline number of drug use days: ATE=2.7, p-value=0.04; ATT=3.21, p-value=0.02.

Conclusions—The trial found a marginally significant effect on improvement in PCS, and significant and stronger effect on the SF-12 physical component among patients with greater frequency of initial drug use.

Keywords

Primary care clinics; Illicit drug use; Screening; Brief intervention; Quality of life

1. INTRODUCTION

Illicit drug use carries a substantial burden given its high prevalence and negative impact on individuals, families, and communities. The estimated cost of illicit drug use in the U.S. is similar to that of other substances - around $181 billion per year compared to $185 billion for alcohol and $193 billion for tobacco (U.S. Department of Justice and National Drug Intelligence Center, 2011). At the population level, preventive interventions need to be undertaken where large groups of individuals seek services on a regular basis. Primary care clinics have regular contact with large, multi-ethnic groups. In primary care, routines and guidelines regarding screening, brief intervention, and referral to treatment (SBIRT) can be implemented (Kamerow et al., 1986; Saitz et al., 2010). There is evidence that reduction in illicit drug use can be achieved using behavior change theories and techniques (Babor et al., 2007; Bernstein et al., 2005; Goldstein et al., 2004; Humeniuk et al., 2012, 2008b; Humphreys and McLellan, 2010). Screening for risky (or problematic) non-dependent drug use in primary care settings followed by brief intervention using provider advice and counseling might interrupt progression to drug dependence and reduce levels of use. Successful brief interventions for drug users not yet dependent provide a cost-effective alternative to the referral to specialized drug treatment required for dependent patients (Humeniuk et al., 2012; John et al., 2013).

While brief interventions have been shown to reduce illicit drug use in outpatient and inpatient settings (Babor et al., 2007; Bernstein et al., 2005; Goldstein et al., 2004; Humeniuk et al., 2012, 2008b; Humphreys and McLellan, 2010), reduced substance use is not, in itself, an adequate criterion for recovery (Donovan, 2012). Reduced substance use or cessation is an important starting-point but a final aim of drug treatment should be to improve patient-centered outcomes (Andersen et al., 2014; Miller and Miller, 2009). ‘Substance abusers seek help quitting drugs not as an end in itself, but as a means to escape the negative consequences and to gain a better life’ (Laudet, 2011). Accordingly, while substance abuse treatment seeks to promote abstinence or reduction in substance use, its ultimate aim is to improve the patient's quality of life (QOL). Patients want substance abuse

treatment to impact very general aspects of QOL - individuals' perception of their position in life within the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns (World Health Organization, 1995). However, the drug addiction field lags behind in acknowledging QOL as an essential outcome of care. Most published studies are on QOL in alcohol dependency and very few involve illicit drug use (Laudet, 2011). Most QOL studies in drug users were conducted outside of the US and few have examined drugs other than opiates (Laudet, 2011).

Expectedly, QOL is worse among substance-dependent individuals and substance abuse treatment seekers compared to the general population (Donovan et al., 2005; Laudet, 2011). Reduction in substance abuse or abstinence is positively correlated with improvements in QOL (De Maeyer et al., 2010). Observational studies suggest that QOL improves during substance abuse treatment (De Maeyer et al., 2011a, 2011b; Tracy et al., 2012). Few trials have tested effects on QOL. An analysis of three trials, which were conducted in community-based outpatient treatment centers for cocaine abuse in Connecticut and Massachusetts (n=393), showed that contingency management was associated with improvement in QOL nine months after randomization (Andrade et al., 2012). Another study of 252 adults in an effectiveness trial of a cognitive behavioral treatment for substance abuse found no substantial effect on QOL after three months (Morgan et al., 2003). Evidence from brief interventions for drug abuse on QOL outcomes from randomized studies is sparse. A brief intervention trial among adolescents achieved reduction in drug use, which was paralleled by improvement in quality of life (Becker et al., 2009, 2011).

Given these inconclusive findings, we used data from the Quit Using Drugs Intervention Trial (QUIT; Gelberg et al., submitted), a brief intervention conducted in federally qualified health centers (FQHCs) among racially diverse, low-income adult patients with risky (non-dependent) drug use to investigate effects on change in health-related QOL (HRQOL) over three months. Since studies have not consistently shown effects on domains of QOL other than mental functioning (Laudet, 2011), we tested treatment effects on both the mental and physical dimensions of HRQOL. In addition, because our previous analysis found QUIT to impact drug use more strongly in those with greater frequency of initial drug use (Gelberg et al., submitted), we performed exploratory subgroup analyses according to levels of initial drug use.

2. METHODS

QUIT was a single-blind randomized controlled trial in five FQHCs in Los Angeles County (LAC). Details of the protocol, brief intervention and primary outcomes have been described elsewhere (Gelberg et al., submitted). The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) was used to screen for problem or risky drug use (Humeniuk et al., 2008a, 2006; McNeely et al., 2014). It contains seven questions about nine substance categories: tobacco, alcohol, marijuana, crack/cocaine, methamphetamine/amphetamine type stimulants, inhalants, sedatives, hallucinogens, and opioids. A score was determined for each substance and is categorized as low, moderate or high risk. The ability of the ASSIST to classify patients based on degree of drug use has been extensively validated (Humeniuk et al., 2012, 2008a). Based on the ASSIST, patients' use of each drug category (excluding

alcohol and tobacco) was scored as: no or low use requiring no intervention (score 0-3); risky use (moderate, non-dependent) requiring clinician brief advice (score 4-26); or high use (most likely dependent) requiring referral (score 27 and above).

2.1 Settings

The clinics were mostly large FQHCs in LAC. Clinic selection was based on robust patient encounter volumes among LAC safety net clinics and consultation with experts on local areas most affected by drug use. Recruitment and enrollment spanned 22 months from February 2011 to November 2012. All five clinics approached agreed to participate.

2.2 Inclusion and exclusion criteria

All persons present in clinic waiting rooms were screened and included in the trial if they were patients at the clinic for a primary care visit and: (1) were risky illicit drug users during the prior three months (ASSIST score between 4 and 26); (2) were18 or older; (3) spoke English or Spanish; (4) expected to be living in the LAC area for the next 3 months; and (5) had an active phone number. Persons at the clinic were excluded if they: (1) were not patients at the clinic for a primary care visit; (2) were not illicit drug users or used infrequently (ASSIST score 0-3); (3) were dependent illicit drug users (ASSIST score ≥27); (4) had been under drug treatment for more than 30 days or (5) were pregnant.

2.3 Randomization

The trial used urn randomization at the patient level for the control (n=163) and intervention group (n=171), with blocking on two strata of the level of drug use (i.e., ASSIST score 4-16, 17-26) (Stout et al., 1994).

2.4 Incentives and Consent

Patients were paid $30 for the initial assessment, $50 for the follow-up assessment and participated in a $500 lottery if they completed all study activities required for the intervention or control condition (as described below). Informed consent was obtained - orally for screening and in writing if they qualified for enrollment. The text of the consent and pre-ASSIST eligibility questions masked the purpose of the study, naming it as the “Living Well Study” to promote healthy lifestyles. The research protocol was approved by the University of California, Los Angeles, Human Subjects Protection Committee.

2.5 Interventions

After the screening process, intervention patients received a brief primary care intervention. They subsequently received a Health Education Booklet and a drug-specific Report Card for their highest ASSIST-scoring drug in the risky range, and viewed an intervention Video Doctor reinforcing the clinicians’ message (Gilbert et al., 2008).

Providers followed a brief scripted protocol based on the patients’ at-risk drug use; two-thirds of the interventions lasted at most 3-4 minutes; only 3 (1.5%) required more than 10 minutes. The protocol included messages about drug addiction being a chronic disease, like heart disease or diabetes; the need to quit or reduce using drugs to prevent this disease; the physical and mental consequences of drug use; and the accelerated progression towards

addiction caused by poly-substance use. If a patient scored in the risky range on multiple drugs, providers would intervene on the patient's highest scoring drug (HSD) on the ASSIST. Providers also told patients that they would receive telephone calls 2 and 6 weeks later from a drug-health educator for counseling.

The telephone drug-use counseling sessions (20-30 minutes each) reinforced the providers' message and followed a scripted patient-centered interview protocol. The health educators were trained in motivational interviewing techniques. The two-week counseling session focused on patients' thoughts about barriers and facilitators to using their HSD (Humeniuk et al., 2008a), willingness to reduce HSD use, goal-setting on quitting/reducing HSD use, patients' plans to achieve their goals, and resource referrals. The six-week counseling session emphasized patients' reflections about additional support that would help in achieving goals, barriers and facilitators to reducing/quitting HSD use, the prior session's resource referrals, and additional referrals they might need. For continuity, the same health educator conducted both sessions. Among intervention patients, 54% received two counseling sessions, 24% received one session, and 22% had no sessions.

Control group patients completed the ASSIST screening but did not receive the provider brief intervention or the counseling sessions. At the baseline visit, they received a booklet and viewed a Video Doctor on cancer screening.

2.6 Measures

Information on ASSIST (McNeely et al., 2014), HRQOL, socio-demographics, behavioral characteristics and drug use was collected using self-administered questionnaires on Tablet computers. Baseline values of the past 30-day use days of the highest scoring ASSIST drug (HSD) were dichotomized at the median of five to indicate lower (<5 days) and higher frequency of drug use (≥5 days)(Gelberg et al., submitted). HRQOL was measured using the Short Form Health Survey (SF-12) (Ware et al., 1996, 1995). The SF-12 mental health component summary score (MCS) and physical health component summary score (PCS) were created from the SF-12 individual responses, with higher scores representing better quality of life.

2.7 Statistical Analyses

Baseline balance between the treatment and control conditions was tested using t tests (continuous variables) and Chi^2 tests (categorical variables). Average treatment effects (ATE = E[Y(1)-Y(0)]) on absolute change between baseline and three-month follow-up in MCS and PCS were estimated using linear regression coefficients. ATE describes the hypothetical gain for all risky drug-using primary care patients. It provides the average difference in outcome between potential outcome scenarios whereby all individuals in the population are either assigned to the treatment or the control condition (Wooldridge, 2010). As Heckman and Vytlacil note, the ATE might not be relevant to decision makers, because it includes the effect on patients for whom the treatment was never intended (Heckman and Vytlacil, 2001). Therefore, we also estimated the average treatment effect on the treated (ATT = E[Y(1)-Y(0)|A=1]), which considers the average gain from brief intervention and is preferable from a policy perspective as it is useful to explicitly evaluate the effect of

treatment on those who actually will receive the brief intervention (Heckman and Vytlacil, 2001). Responsiveness was examined as a way to determine clinically important change and was measured using the standardized response mean (SRM; Revicki et al., 2008). The SRM was calculated as the absolute mean change divided by the standard deviation of change for the sample; values of 0.2 represent a small change, 0.5 a medium change, and 0.8 a large change (Revicki and Hays, 2004).

Regression models were adjusted for the baseline values of MCS (or PCS), baseline days of HSD use, age, sex, race (white vs. non-white), the interval between the baseline and follow-up assessments, and clinic indicators. These covariables were included based on study goals, preliminary analyses for baseline imbalance (Austin et al., 2010), and nesting of patients within clinics. We tested whether dropout rates differed between both conditions and whether baseline values were related to dropout. Because there was a non-significant trend that individuals in the intervention group were more likely to be lost-to-follow-up (adjusted odds ratio from multivariable logistic regression=1.7, p-value: 0.11), possibly violating the missing-completely-at-random assumption, we performed intention-to-treat analyses based on multiply imputed data (White et al., 2012; White et al., 2011). Fifty sets of imputed values were produced. Because our previous analysis found that the effect of QUIT is stronger in patients with greater frequency of baseline drug use (Gelberg et al., submitted), we performed subgroup analyses below and above the median baseline HSD of less < or ≥ five drug use days (with Ns of 154 and 180, respectively).

Additional exploratory subgroup analyses were performed by the HSD. We used a doubly robust inverse probability weighted regression-adjusted estimator of ATE and ATT as a sensitivity analysis to test the robustness of our findings (Bang and Robins, 2005). Finally, a linear regression model, with fractional polynomials to model non-linear relations, was used to associate change in HSD over the past 30 days between baseline and follow-up with change in MCS and PCS. Analyses were performed using Stata 13.1 (Stata Corp., College Station, TX, USA).

3. RESULTS

Of the 15,648 persons observed in clinic waiting rooms 18% declined to be screened, 15% were not at the clinic for their own visit, 14% had a non-primary care visit, 10% were previously screened, 5% were pregnant, and 13% did not meet the other study inclusion criteria or were unable to complete the ASSIST (Figure 1); leaving 25% (3915 patients) who met the inclusion criteria and completed the ASSIST. Of the 3,915 ASSIST completers, 413 were identified as risky drug users and 334 (81%) consented to participate in the trial. At three months, the follow-up rate was 78% (n=261).

3.1 Baseline Characteristics

The average age was 41 years, 63% of the participants were men, 84% had more than 12 years of education, and all of the largest ethnic groups were well represented: Hispanic (34%), African American (23%) and white (38%; Table 1). Means (standard deviations) for MCS and PCS in the total sample were 42.8 (12.4) and 43.0 (12.0), respectively. MCS had a minimum of 12.3 and a maximum of 68.3; the PCS ranged from 13.9 to 64.7. The mean of

the highest scoring drug's ASSIST scores at baseline was 14.5 and the most common HSD was cannabis (52%), followed by stimulants (32%). Groups were well balanced at baseline, including both SF-12 measures (Table 2).

3.2 Estimates of Treatment Effects and Responsiveness

The crude changes of the MCS and PCS were not significantly different between groups, although the improvement in the PCS for the intervention group was marginally higher than that for the control group (Table 2). After multiple imputation for loss-to-follow-up and adjustment for covariables, the ATE on change in the PCS was 1.65 points (Table 3). The ATE estimate for change in MCS was not significantly different between groups. SRMs for the total sample were 0.13 for MCS and 0.23 for PCS, respectively (Table 1). Next, we tested whether ATEs varied by the frequency of baseline drug use. We found a significant interaction term between baseline HSD use days and the treatment condition on average change in PCS. Improvement in PCS was stronger in patients with baseline HSD > five days, with an estimated ATE of 2.74.

For the total sample, the ATT on PCS was 1.94, with a borderline significant p-value of 0.056 (Table 4). The ATT in those with baseline HSD > five days was 3.21. Because effects might vary by the highest scoring drug, we performed some exploratory analyses and stratified our estimation of ATEs on the HSD drug (Table 5). ATEs for cannabis users indicate a negative change in MCS; while cocaine and amphetamine type drug users, sedative users and opioid users showed a positive effect on change in MCS. In contrast, the ATE for PCS was highest for cocaine users and lowest for opioid users. Doubly robust estimators of ATEs and ATTs were similar to the estimates derived from standard regression adjustment.

3.3 Association between change in frequency of HSD drug use days between baseline and follow-up and change in HRQOL scores

We regressed change in MCS and PCS between baseline and follow-up on change in days of HSD drug use over past 30 days. Figure 2 shows that change in the number of days of HSD was inversely correlated with change in MCS, after multivariable adjustment (p-value: 0.047). Change in the number of days of HSD was not associated with change in PCS (p-value: 0.357).

4. DISCUSSION

To our knowledge, this is the first exploratory trial to examine the effects on HRQOL of an outpatient brief intervention among risky non-dependent drug using adult primary care patients. Mean values of our HRQOL measures were comparable with those of other drug using populations but lower than those of the general population (Gonzales et al., 2009; Holland et al., 2014; Lev-Ran et al., 2012). For example, in a sample of methamphetamine-dependent individuals mean and standard deviation for MCS and PCS were 39.2 (13.1) and 50.6 (9.0), respectively (Gonzales et al., 2009).

We found a marginally significant main effect on improved physical functioning and a significant and stronger effect on physical functioning among risky drug using patients with

greater frequency of drug use. Estimated ATEs on three-month PCS change were 1.7 among all risky drug users, and 2.7 for those with higher baseline drug use. The ATT for high baseline users was slightly larger than the corresponding ATE, indicating that the compliant subgroup of risky drug using patients might benefit more from the short intervention (Heckman and Vytlacil, 2001). Although largely non-significant and underpowered, analyses stratified on the type of the highest scoring ASSIST drug indicate that the ATE on MCS might be stronger in patients scoring high on sedatives and opioids, while positive effects on PCS might be stronger in cannabis and cocaine users. Larger pragmatic trials are needed to test efficacy of brief interventions in routine clinical practice with improved statistical power. To detect an ATE on the PCS of 1.7 at p=0.05 would require about 400 subjects at 1-ß of 80%. However, to reduce the likelihood of false-positive findings in subgroup analyses, a sample size roughly four times as large is required for detecting a difference in subgroup analyses (Velentgas et al., 2013).

ATEs and ATTs seem relatively small and might not be clinically meaningful. A meaningful change in subjective health and QOL might be one that is caused by the patient's perception of reduction in symptoms or improvement in physical, psychological, and social functioning (Crosby et al., 2003). Therefore, we also studied responsiveness as a measure of clinical or practical relevant change (Revicki et al., 2008). The SRM for mental functioning was small (i.e., SRM<0.2) and the SRM for physical functioning was small-to-moderate (i.e. SRM<0.5). Another way to assess the clinical relevance of patient-reported outcomes is the minimal important difference or minimal clinically important difference (MCID), defined as 'the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management' (Jaeschke et al., 1989). There are no published MCIDs for SF-12 measures in persons receiving brief interventions or treatment for substance abuse. However, studies among patients with symptomatic pseudoarthrosis (Parker et al., 2012) and epilepsy (Wiebe et al., 2002) suggest that a 3.2-point change in PCS and 4-point change in MCS over one year might be clinically relevant.

To our knowledge, no studies have been conducted testing the effect of a brief intervention for risky non-dependent drug use on HRQOL. However, there are few studies testing effects of more intensive outpatient substance abuse treatment on QOL and HRQOL. Three randomized controlled trials conducted in community-based outpatient treatment centers for cocaine abuse compared a standard intensive outpatient treatment (i.e., group therapy, coping and life skills training, relapse prevention, 12-step treatment) with contingency management (CM) treatment (i.e., reinforcement for abstinence and/ or completion of goal-related activities). Pooled analyses of the trials found improvement of QOL (measured using the Quality of Life Inventory) in the CM but not in the standard care group over nine months (Andrade et al., 2012). Another effectiveness trial comparing cognitive behavioral treatment and usual care for substance abuse found negligible effects on functioning and HRQOL (measured using the SF-36 Health Survey) after three months (Morgan et al., 2003; Morgenstern et al., 2001). A larger trial of 723 methamphetamine-dependent patients showed larger one-year improvement in the mental than in physical dimension of the SF-36 (Gonzales et al., 2009). Improvements in MCS for those receiving more services (treatment completers plus continuing care) were 9.6 points over one year and 2.2 points for those who

got the fewest services (Gonzales et al., 2009). The relevance of short-term improvements in HRQOL detected in our study is emphasized by a study that found that QOL at the end of outpatient treatment predicts sustained long-term abstinence (Laudet et al., 2009).

Wilson and Cleary (1995) provided a conceptual model that considers QOL as an outcome of a systemic process. Physiological factors are assumed to influence signs and symptoms, which affect patients' subjective perception and clinical evaluation. Signs and symptoms then cause functioning, which in turn predicts health perception and HRQOL. Thus, in this framework HRQOL is the endpoint that is affected by improvement in drug-related subjective symptoms. A study analyzing data from a randomized controlled trial of opioid users applied the Wilson and Cleary framework and found that greater withdrawal symptoms predicted lower HRQOL, directly and via addiction severity (Heslin et al., 2011). Because greater withdrawal symptoms reflect heavier drug use, this might explain why QUIT affected HRQOL only in subjects with higher levels of baseline drug use. There is some evidence that pre-treatment and post-treatment QOL predicts long-term reduction in drug use and abstinence (Laudet et al., 2009; Newman, 2012). Against this background, it seems plausible to assume that QOL can be considered a determinant of substance-use related outcomes and long-term remission as well as a secondary long-term outcome of brief intervention. Patient's sense of improvement in their QOL as a result of reducing their risky drug use could also serve as a motivator for maintenance of this behavior change. To examine this issue in more detail, we related change in number of HSD use days between baseline and follow-up with change in HRQOL scores. We found that a decrease in the frequency of drug use is associated with an improvement in mental but not in physical HRQOL.

The findings of our study need to be interpreted in the context of potential limitations. First, the external validity might be limited and power reduced by screening-positives that refused to participate in the trial. Second, patients in the control group didn't get any phone conversations and may have spent less time with the clinician so overall they got less personalized attention than patients in the intervention arm. Thus, part of the treatment effects detected could be due to insufficient attention-control in the control arm. Third, the SF-12, a measure of HRQOL, was used as an outcome. The SF-12 measures HRQOL, which is embedded in a pathology-focused model of QOL. Future studies might apply broader measures of QOL that describe how satisfied people are with various aspects of their life (Laudet, 2011; Laudet et al., 2009). The World Health Organization Quality of Life Assessment (WHOQOL) and its shorter version, the WHOQOL-BREF are instruments that are based on this concept of overall QOL (World Health Organization, 1995, 1998). Last, future studies might collect more clinic level information to better control for heterogeneity and clinic-level effects in regression models.

In conclusion, this study provided first results of a brief drug use reduction intervention among risky drug users encountered in a primary care environment on short-term changes in HRQOL. Secondary outcomes including subjective health, QOL, wellbeing, life satisfaction and happiness might be important long-term goals of drug treatment (Miller and Miller, 2009). More randomized effectiveness and implementation trials with longer follow-up times are needed to provide stronger evidence for the effects of brief interventions like

QUIT on QOL. Larger studies would also provide the opportunity to study subgroup-effects and the mechanisms by which how brief interventions cause improvements in QO

Acknowledgments

We gratefully acknowledge the following, without whose support we could not have conducted this study. The National Institute on Drug Abuse, our funder and greatest supporter: Wilson Compton, MD, MPE, Eve Reider, PhD, and Jacqueline Lloyd, PhD. The hard working clinicians and staff of our study clinics. The patients who were willing to participate in the study. A special thank you to Hendricks Brown and Juan Villamar from the Center for Prevention Implementation Methodology (Ce-PIM) NIDA P30 DA027828. Our colleagues and collaborators: Abdelmonem A. Afifi, UCLA Fielding School of Public Health; Robert Ali, MD, University of Adelaide; Corey Arnold, PhD, UCLA Medical Imaging Informatics; C. Hendricks Brown, PhD, Northwestern University; Alex Bui, PhD, UCLA Medical Imaging Informatics; Michael F. Fleming, MD, Northwestern University; Sonya Gabrielian, MD, MPH, VA Greater Los Angeles Healthcare System; Mars Lan, PhD, UCLA Department of Computer Science; Michael McCoy, MD, Regenstrief Institute; Adeline Nyamathi, ANP PhD FAAN, UCLA School of Nursing; Majid Sarrafzadeh, PhD, UCLA Department of Computer Science; Steve Shoptaw, PhD, UCLA Department of Family Medicine. The medical directors of our study clinics: Maria Chandler, MD, MBA, Paul Gregerson, MD, MBA, Karen Lamp, MD, Elisa Nicholas, MD, MSPH, Jehni Robinson, MD, Michael Hochman, MD, MPH, and Martin Serota, MD. Senior Statistician: Yihang Liu. Health Educators: Nell Baldwin, Yohanna Barth-Rogers, Janet Beyan, Jacqueline Euan, Peggy Leung, Yu-Ming Ni, Alex Rice, and Kelly Townsend. Research Assistants: Rahul Abraham, Maureen Albia, Claire Alvarenga, Esther Baek, Ryan Bakhit, Nataly Barragan, Daniel Benhuri, Ben Benhuri, Vasthi Becerra, Ashley Brumell, Cindy Chen-Wu, Ryane Daniels, Evelyn Diego, Pauline Do, Colleen Duro, Phil Garrity, Rahel Gebregziabher, Nora Ghodousi , Kidan Habtay, Lea Heller, Marissa Hernandez, Niree Hindoyan, Aida Martinez, Sareen Melikian, Hannah Mendoza, Edward Mezian, Blake Johnson, Aram Kim, Camille King, Jinsol (Gene) Lee, Jordan McCrary, Angel Mendoza, Jose Muniz Castro, Maki Nakazato, Christian Neckelmann, Gem Nelson, Osose Oboh, Beverly Okereke , Daniel Pak, Hahnnah Park, Rakshya Pokharel, Francesca Rozo, Desiree Sanchez, Henry Teaford, Ashley Torkan, Daniel Toro-Lira, Clara Tsou, Gina Tucker, Anmy Vu, Christine Vu, Hugo Yepez, and Charlette Yoon.

Role of Funding Source

This research was funded primarily by a grant from NIDA (“Preventing Drug Use in Low Income Clinic Populations.” R01 DA022445-01). Ronald Andersen received additional support from the UCLA/DREW Project EXPORT, National Center on Minority Health and Health Disparities, P20MD000148/P20MD000182. Sebastian E. Baumeister received travel expenses for short stays at UCLA from the International Office at the University of Greifswald.

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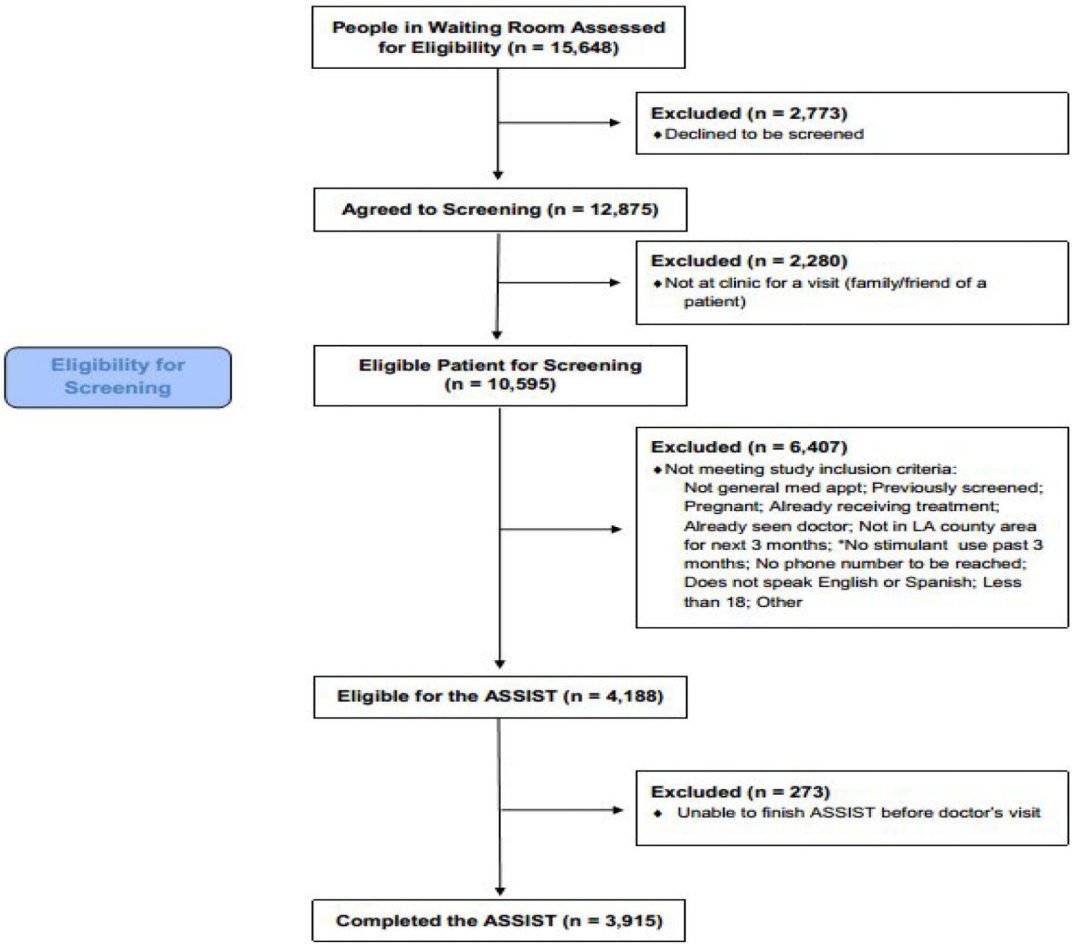
Highlights

- Improvement in quality of life (QOL) is a long term goal of drug treatment.
- We examined the effect of a brief intervention among risky (non-dependent) illicit drug using patients of five health centers in the US on health-related quality of life (HRQOL) after three month.
- The intervention improved the physical domain of HRQOL.
- The brief intervention's effect was stronger among patients with greater frequency of initial drug use.

QUIT CONSORT Flow Diagram



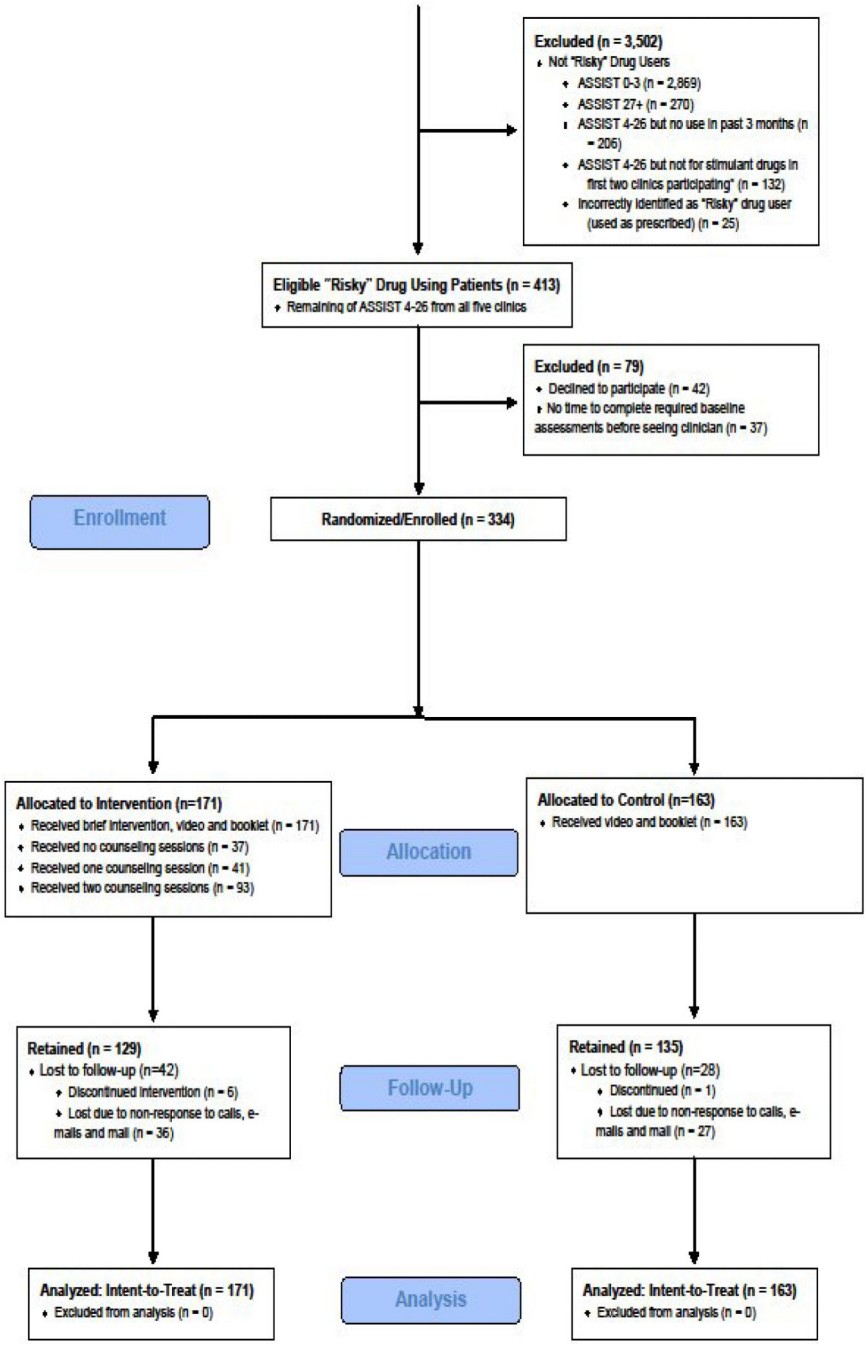


Figure 1.
Flow chart

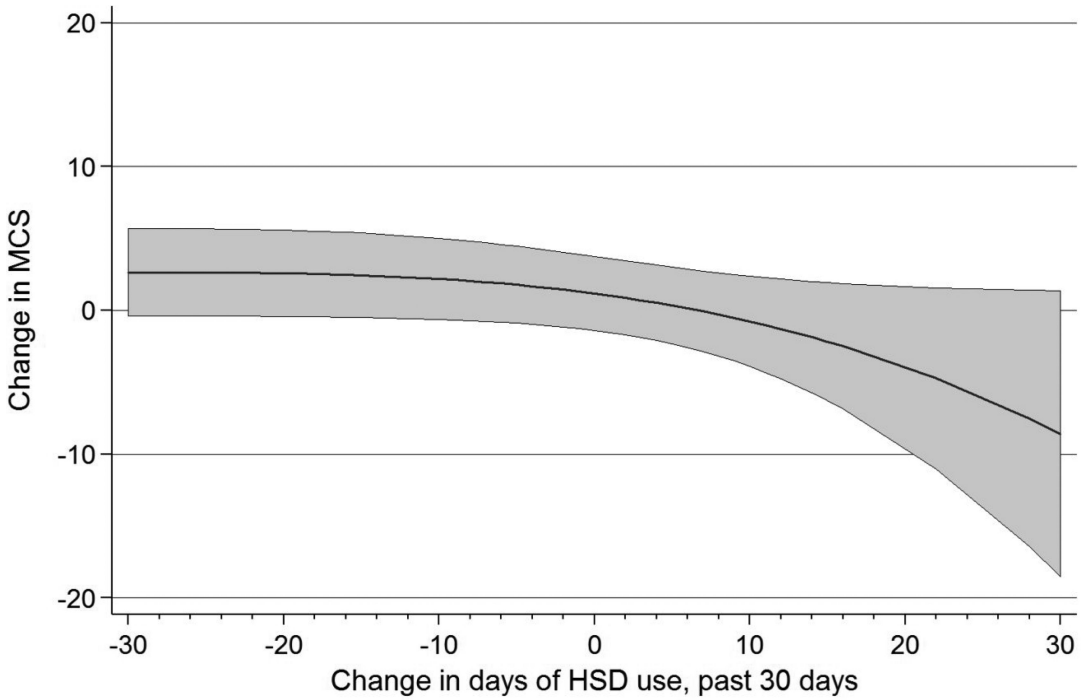


Figure 2.

Association between change in MCS and change in HSD from baseline to follow-up. P-value for 'change in days of HSD drug use': 0.047.Fractional polynomial regression models adjusted for baseline values of each outcome, baseline days of HSD use, age, sex, race/ethnicity, the interval between the baseline and follow-up assessments, and four dummy clinic variables. MCS, SF-12 mental component summary score. HSD, highest scoring drug

Table 1

Baseline characteristics of the study: total sample and stratified by treatment group

	Total sample (n = 334)	Control group (n = 163)	Intervention group (n = 171)	p-value*
Age, yrs	41.7 (12.7)	40.8 (13.1)	42.4 (12.3)	0.250
Male, n (%)	210 (62.9)	97 (59.5)	113 (66.1)	0.214
Education ≥ 12yrs, n (%)	253 (83.8)	124 (84.4)	129 (83.2)	0.790
Race/Ethnicity, n (%)				0.616
White	126 (37.7)	63 (38.7)	63 (36.8)	
African American	76 (22.8)	34 (20.9)	42 (24.6)	
Hispanic	113 (33.8)	56 (34.4)	57 (33.3)	
Other	19 (5.7)	10 (6.1)	9 (5.3)	
U.S. Born, n (%)	286 (87.2)	140 (87.5)	146 (86.9)	0.870
Marital status, n (%)				0.074
Married	39 (11.7)	11 (6.8)	28 (16.4)	
Widowed	11 (3.3)	5 (3.1)	6 (3.5)	
Separated	24 (7.2)	10 (6.2)	14 (8.2)	
Divorced	67 (20.2)	34 (21.0)	33 (19.3)	
Never married	191 (57.5)	101 (62.7)	90 (52.6)	
Parenting status (children < 18 yrs), n (%)	71 (21.3)	35 (21.6)	36 (21.1)	0.902
Homeless history, n (%)				
Homeless, lifetime	203 (61.0)	94 (58.0)	109 (63.7)	0.285
Homeless, current	86 (26.2)	36 (22.4)	50 (29.9)	0.119
Income ≤ $500/month, n (%)	193 (58.0)	93 (57.4)	100 (58.5)	0.843
Insurance, past 3 months, n (%)	109 (32.7)	53 (32.7)	56 (32.8)	0.995
Number of chronic medical conditions	1.1 (1.1)	1.1 (1.1)	1.1 (1.1)	0.645
Baseline HSD ASSIST Score (range 4-26)	14.5 (6.6)	14.3 (6.5)	14.6 (6.7)	0.609

Data are given as absolute numbers and percentages or means (standard deviations).

HSD, highest scoring drug on the ASSIST

*Group comparisons by group were performed using Chi2 test for categorical variables and t- test for continuous variables.

Table 2

Unadjusted average change in quality of life measures (baseline to 3 months) among risky drug using patients, by treatment group

Outcome measures	Control group		Intervention group		Group difference in average change		
	Baseline	3 month follow-up	Baseline	3 month follow-up		p-value*	SRM
	Mean						
SF-12 mental component summary score							
Arithmetic mean (SD)	42.94 (12.28)	44.39 (12.21)	42.69 (12.57)	43.71 (11.78)			
Minimum – maximum	13.04 - 62.45	21.14 - 68.94	12.30 - 68.27	10.94 - 65.45	0.25	0.848	0.13
SF-12 physical component summary score (13.9 – 64.7)							
Arithmetic mean (SD):	43.10 (12.01)	44.47 (12.21)	42.97 (12.11)	45.07 (12.18)			
Minimum – maximum	18.8 - 64.2	12.39 - 62.82	13.89 - 64.73	15.08 - 65.56	1.59	0.115	0.23

SD, standard deviation.

SRM, standardized response mean.

*Group comparisons of unadjusted changes were performed using t-tests.

Table 3

Average treatment effects (ATE) on change in quality of life measures among risky drug using patients, by group and baseline drug use

	SF-12 mental component summary score	SF-12 physical component summary score
	ATE (95%-CI)	**ATE (95%-CI)**
Total sample		
Control group	*Ref.*	*Ref.*
Intervention group	0.19 (−2.10, 2.49)	1.65 (−0.19, 3.51)
p-value*	0.867	0.080
Stratified by baseline days of HSD use		
P-Value for interaction	0.783	0.024
Low Baseline use (< 5 days of HSD use, past 30 days)		
Control group	*Ref.*	*Ref.*
Intervention group	0.58 (−3.02, 4.19)	−0.30 (−3.19, 2.59)
p-value*	0.750	0.84
High Baseline use (≥ 5 days of HSD use, past 30 days)		
Control group	*Ref.*	*Ref.*
Intervention group	0.11 (−3.13, 3.34)	2.74 (0.16, 5.33)
p-value*	0.949	0.037

ATE were estimated using linear regression coefficients based on multiply imputed data (50 datasets). Models adjusted for baseline values of each outcome, baseline days of HSD use, age, sex, race/ethnicity, the interval between the baseline and follow-up assessments, and four dummy clinic variables.

CI, confidence interval. HSD, highest scoring drug on the ASSIST

* p-value from linear regression.

Table 4

Average treatment effects on the treated (ATT) on change in quality of life measures among risky drug using patients, by group and frequency of HSD baseline drug use

	SF-12 mental component summary score	SF-12 physical component summary score
	ATT (95%-CI)	**ATT (95%-CI)**
Total sample		
Control group	*Ref.*	*Ref.*
Intervention group	0.13 (−2.68, 2.95)	1.94 (−0.05, 3.92)
p-value*	0.926	0.056
Low Baseline use (< 5 days of use of HSD in the past 30days, n=154)		
Control group	*Ref.*	*Ref.*
Intervention group	0.55 (−3.62, 4.73)	0.17 (−2.69, 3.03)
p-value*	0.796	0.907
High Baseline use (≥ 5 days of use of HSD in the past 30 days, n=180)		
Control group	*Ref.*	*Ref.*
Intervention group	−0.70 (−4.28, 2.87)	3.21 (0.46, 5.96)
p-value*	0.700	0.022

Models adjusted for baseline values of each outcome, baseline days of HSD use, age, sex, race/ethnicity, the interval between the baseline and follow-up assessments, and four dummy clinic variables.

CI, confidence interval. HSD, highest scoring drug on the ASSIST

* p-value from linear regression.

Table 5

Average treatment effects (ATE) on change in quality of life measures among risky drug using patients, by HSD

	SF-12 mental component summary score	SF-12 physical component summary score
	ATE (95%-CI)	**ATE (95%-CI)**
Cannabis (n=137)		
Control group	*Ref.*	*Ref.*
Intervention group	−1.36 (−4.51, 1.80)	2.39 (−0.01, 4.78)
p-value*	0.398	0.051
Cocaine (n=50)		
Control group	*Ref.*	*Ref.*
Intervention group	1.01 (−4.87, 6.89)	4.31 (−1.14, 9.76)
p-value*	0.731	0.119
Amphetamine type stimulants (n=28)		
Control group	*Ref.*	*Ref.*
Intervention group	1.04 (−7.20, 9.27)	1.01 (−5.06, 7.07)
p-value*	0.797	0.735
Sedatives (n=24)		
Control group	*Ref.*	*Ref.*
Intervention group	2.74 (−6.70, 12.19)	−0.542 (−6.55, 5.47)
p-value*	0.550	0.852
Opioids (n=20)		
Control group	*Ref.*	*Ref.*
Intervention group	4.21 (−6.71, 15.12)	−4.18 (−12.69, 4.33)
p-value*	0.424	0.312

Models adjusted for baseline values of each outcome, age, and sex.

CI, confidence interval. HSD, highest scoring drug on the ASSIST

*p-value from linear regression.