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Improvements in Health-related Quality of Life among Methadone Maintenance Clients in Dar es Salaam, Tanzania

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Abstract

Background—Injection of heroin has become widespread in Dar es Salaam, Tanzania and is spreading throughout the country. To prevent potential bridging of HIV epidemics, the Tanzanian government established a methadone maintenance treatment (MMT) clinic in February 2011. We assess the effect of MMT on health-related quality of life (HRQOL) and examine factors, particularly HIV infection and methadone dose, associated with changes in HRQOL.

Methods—This study utilized routine data on clients enrolling in methadone from February 2011 to April 2012 at Muhimbili National Hospital. Change in physical (PCS) and mental health (MCS) composite scores, as measured by the SF-12 tool, were the primary outcomes. Backward stepwise linear regression, with a criterion of $p<0.2$ was used to identify baseline exposure variables for inclusion in multivariable models, while adjusting for baseline scores.

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Conflicts of Interest

We declare that we have no conflicts of interest.

Results—A total of 288 MMT clients received baseline and follow-up assessments. Mean methadone dose administered was 45 mg (SD±25) and 76(27%) were confirmed HIV-positive. Significant improvements were observed in PCS and MCS, with mean increases of 15.7 and 3.3, respectively. In multivariable models, clients who had previous poly-substance use with cocaine [p=0.040] had a significantly higher mean change in PCS. Clients who were living with HIV [p=0.002]; satisfied with current marital situation [p=0.045]; had a history of suicidal thoughts [p=0.021]; and previously experienced cognitive difficulties [p=0.012] had significantly lower mean change in PCS. Clients with shorter history of heroin use [p=0.012] and who received higher methadone doses [p=0.028] had significantly higher mean change in MCS, compared to their counterparts.

Discussion—Aspects of mental and physical health, risk behaviors and quality of life among drug users are intertwined and complex. Our research revealed positive short-term effects of MMT on HRQOL and highlights the importance of sustained retention for optimal benefits. Comprehensive supportive services in addition to provision of methadone are needed to address the complex health needs of people who inject drugs.

Keywords

Methadone; Tanzania; Quality of Life; Harm Reduction; Implementation Science

Background

During the mid-1980s, East Africa became an important drug transit stop, introducing heroin in the region. As a consequence, the region also became a point of consumption, with an estimated 533,000 opiate users in East Africa (UNODC, 2011). Since the late 1990s, the injection of heroin has become widespread in Dar es Salaam, Tanzania and is spreading throughout the country (McCurdy, Williams, Kilonzo, Ross, & Leshabari, 2005; Ross, McCurdy, Kilonzo, Williams, & Leshabari, 2008; UNODC, 2011). The injection of heroin and other illicit substances contributes to the development of acute and chronic medical conditions, leading to higher morbidity and mortality (Gupta et al., 2014; Kessler et al., 2013; Mathers et al., 2013; UNODC, 2013).

People who inject drugs (PWID) in Dar es Salaam have a disproportionately high disease burden with an estimated HIV prevalence of 42%–50%, hepatitis C prevalence of 56–76% and an active pulmonary TB prevalence of 4%–11% (Gupta et al., 2014; Msami, 2004; Nyandindi et al., 2013; Williams et al., 2009). PWID are often socially marginalized and face multiple psychiatric co-morbidities (Altice, Kamarulzaman, Soriano, Schechter, & Friedland, 2010). Drug users often have lower health-related quality of life (HRQOL), especially with regards to mental health conditions when compared to the general population or patients with other chronic conditions such as hypertension or diabetes (Deering et al., 2004; Ryan & White, 1996; Smith & Larson, 2009). More recently, HRQOL has become an important outcome in clinical trials and medical interventions for chronic diseases (Osoba, 2011).

Methadone maintenance treatment (MMT) is one type of treatment for opioid dependence and is a component of the comprehensive package of HIV services for people who use

opioids (PEPFAR, July 2010). Extensive research supports methadone maintenance as an effective treatment for opioid dependence, associated with lowering morbidity and mortality and reducing risk behaviors associated with opioid injection (Bruce, 2010; Connock et al., 2007; Gibson, Flynn, & McCarthy, 1999; JC & A, 1991; Metzger et al., 1993). A systematic review examining 13 programs in Asia and Eastern Europe noted significant improvements in quality of life, as measured by the WHOQOL-BREF tool, and significant reductions in addiction severity over time among participants enrolled in opioid agonist treatment such as methadone (Feelemyer, Jarlais, Arasteh, Phillips, & Hagan, 2013).

In response to the emerging injection drug use crisis, the government of Tanzania established the first publicly funded MMT clinic on the mainland of sub-Saharan Africa. We hypothesized that MMT is associated with improvements in HRQOL but differential improvements would be observed based on baseline risk factors. We conducted a retrospective cohort study to understand the effect of MMT on health-related quality of life and factors associated with changes in HRQOL over time. To our knowledge, this is one of the first studies examining HRQOL among methadone clients in sub-Saharan Africa.

Methods

Study Setting

In February 2011, the Tanzania AIDS Prevention Project launched the first MMT clinic in Tanzania, offering methadone, at Muhimbili National Hospital in Dar es Salaam. The establishment of methadone services was supported by the Tanzanian government – namely, the Ministry of Health and Social Welfare and Drug Control Commission – as well as the U.S. Centers for Disease Control and Prevention (CDC), Muhimbili University of Health and Allied Sciences, and Pangaea Global AIDS (Pangaea). The methadone program has been previously described in detail (Bruce et al., 2014; Gupta et al., 2014; Barrot H Lambdin et al., 2013; B. H. Lambdin et al., 2014; Tran et al., 2015). Briefly, the clinic provides methadone to clients seven days a week by direct observation and offers integrated services such as counseling and testing for HIV and hepatitis, tuberculosis testing and daily observed treatment, mental health, and psychosocial support (Bruce et al., 2014).

Study Population

Study subjects included 288 clients of the 419 (69%) who enrolled into the methadone program from February 2011 to April 2012 at Muhimbili National Hospital and met the below criteria. Inclusion criteria for methadone initiation included: 1) opioid dependence, 2) evidence of recent drug injection, and 3) positive opiate urine screening. Other additional study criteria included: 1) 18 years of age or older, 2) complete baseline data collection within one week of enrollment and 3) a completed follow-up assessment 3 to 6 months post enrollment into the methadone program.

Data Sources

The study utilized the electronic database at the MMT clinic at Muhimbili National Hospital. As part of routine care, MMT clients were asked to complete a comprehensive baseline survey to collect demographic, drug history, legal history, mental health (depression

and anxiety), and HIV risk behavior data. The survey also included the health-related quality of life tool (SF-12) (Ware, Kosinski, & Keller, 1996)which has been previously used and validated in the Tanzanian context (Atkinson, Mccurdy, Williams, Mbwambo, & Kilonzo, 2011; Kaaya et al., 2002; Lee, Kaaya, Mbwambo, Smith-Fawzi, & Leshabari, 2008; Magafu et al., 2009; Wagner et al., 1999; Wyss et al., 1999). The follow-up survey contained the same components and was completed between three to six months after baseline.

Measures

Exposures—Patient-level characteristics were extracted from the MMT electronic database. Demographic factors included age (≤25, 26–35, ≥36);sex (male/female); education level (primary schooling or lower); current marital status (married/unmarried); parental status (has children/does not have children); current employment status (formally employed/unemployed); and baseline HIV status (positive or negative result within 90 days of methadone enrollment). Drug-use history factors included length of heroin use (in years) and poly-substance use (heroin with alcohol, cocaine, or benzodiazepine). Injection-related risk behaviors, mental health domains and history of abuse were analyzed as dichotomous exposure variables (yes/no). Injection-related risk behaviors included “flashblood” (injecting blood from another drug user who has recently injected heroin) (McCurdy, Ross, Williams, Kilonzo, & Leshabari, 2010); sharing needles at last injection; and sharing other equipment at last injection. Mental health domains included high substance dependence (defined as having the maximum score of a 7-point scale) ((APA), 2000); depression in the last 30 days; anxiety in the last 30 days; a history of suicidal thoughts or attempts; hallucinations (visual or auditory); cognitive difficulties with understanding, concentrating, or remembering; violent behavior; satisfaction with current marital status; and satisfaction with current living situation. History of abuse was characterized as any self-reported history of physical abuse or sexual abuse. MMT-associated treatment factors included average daily dose during the first three months of treatment. Methadone dose was categorized into above (≥85 mg) and below (<85 mg), based on a Cochrane review of methadone dosing and previous research among this client population (Brady et al., 2005; Fareed, Casarella, Amar, Vayalapalli, & Drexler, 2010; B. H. Lambdin et al., 2014; Mattick, Kimber, Breen, & Davoli, 2008; Tran et al., 2015).

Outcomes—Change in health-related quality of life, as measured by the SF-12 tool (v1) (Ware et al., 1996; Ware, Snow, Kosinski, & Gandek, 1995) was the primary outcome of interest. The tool included all 12 questions that measure functional health and well-being from the patient’s point-of-view. The SF-12 has been extensively validated, is well-accepted by patients, and performs well across diverse population groups. In particular, SF-12 has demonstrated excellent reliability and validity in the general population (Ware et al., 1996); among individuals with severe mental illness and substance dependence (Salyers, Bosworth, Swanson, Lamb-Pagone, & Osher, 2000); and among people living with HIV (Chariyalertsak et al., 2011; Delate & Coons, 2000; Han, Pulling, Telke, & Huppler Hullsiek, 2002; Viswanathan, Anderson, & Thomas, 2005; Wu, Hays, Kelly, Malitz, & Bozzette, 1997). The use of the SF-36, from which the SF-12 is based, has also demonstrated validity in Tanzania (Magafu et al., 2009; Wagner et al., 1999; Wyss et al., 1999). Data were collected at baseline and at three to six months follow-up and extracted

from the MMT electronic database for analysis. Overall Physical and Mental Health Composite Scores (PCS and MCS, respectively) at baseline and follow-up were computed according to standard protocol (Ware et al., 1995). Then, the change in scores between baseline and follow-up was calculated for each composite.

Statistical Methods

Paired Student T–tests were used to examine differences between mean HRQOL scores of participants before and after initiation of methadone treatment.

Multivariable linear regression with robust standard errors was used to identify independent baseline predictors of HRQOL changes. Backward stepwise regression with a p-value of 0.2 was used to select variables for inclusion in the final multivariable model. All analyses were adjusted for baseline composite scores. Throughout this study two-tailed p-values, with p<. 05 were considered to be statistically significant. All statistical analyses were conducted using Stata 12.1 (College Station, TX).

Ethical Considerations

Ethical clearance was granted by Muhimbili University of Health and Allied Sciences (MUHAS) Research and Publication Committee in Dar es Salaam, Tanzania. The use and analysis of de-identified, programmatic data was also approved by the U.S. Centers for Disease Control and Prevention, E&I Review Services in the United States as program evaluation and non-human subjects research.

Results

MMT Clients

A total of 288 MMT clients were included in this study. Baseline characteristics of enrolled patients are presented in Table 1. Overall, 260 (90%) were male; 162(56%) had primary education or lower; 93 (32%) had children; 36 (13%) were married, and 238 (83%) were unemployed. Median length of heroin use was 10 years (IQR: 6, 15) and 5 (2%), 65 (22%) and 39 (14%) reported poly-substance use with cocaine, alcohol, benzodiazepine, respectively.

Improvements in HRQOL

At baseline, mean overall Physical and Mental Health Composite Scores were 37.9 (95% CI: 36.7, 39.0) and 38.4 (95% CI: 37.5, 39.3), respectively. Significant improvements in both scores between baseline and follow-up were observed (p<0.001). At follow-up, PCS scores made a large improvement, increasing by an average of 15.7 points to 53.6 (95% CI: 52.6, 54.6) and MCS scores made a small to medium improvement, increasing by an average of 3.3 points to 41.7 (95% CI: 40.1, 42.4).

Predictors of Changes in HRQOL

Table 2 shows the associations of baseline characteristics with changes in PCS in univariate and multivariable models. In the adjusted model, MMT clients who had previous poly-substance use with cocaine [p=0.040] had a significantly higher mean change in PCS.

Patients who were living with HIV [p=0.002]; satisfied with their current marital situation [p=0.045], had a history of suicidal thoughts [p=0.021], and had previously experienced cognitive difficulties [p=0.012] had significantly lower mean change in physical component scores as compared to their counterparts.

Table 3 presents results of univariate and multivariable linear regression models of the associations of baseline characteristics with changes in Mental Health Composite Scores. In the adjusted model, MMT clients who had a longer history of heroin use had significantly lower mean change in mental health composite score, compared to clients who had a shorter history of heroin use [p=0.012], and people with a higher methadone dose at initiation had a significantly higher mean change in mental health composite score, compared to people with a lower methadone dose at initiation [p=0.028].

Discussion

Utilizing data from the first publicly funded methadone clinic on the mainland of Sub-Saharan Africa, this study compared HRQOL among PWID prior to and three to six months after MMT initiation and examined factors associated with changes in HRQOL. Consistent with research documenting the impact of MMT on quality of life (Feelemyer et al., 2013), we observed significant short-term improvements in HRQOL, on average, in the first cohort of opioid addicts receiving MMT in Tanzania. Longer duration on methadone may lead to even larger improvements in HRQOL and future analyses will attempt to examine long term, sustained changes in HRQOL.

Greater improvements were seen in PCS than MCS, suggesting that methadone may have more immediate effects on physical health than mental health. Despite significant improvements, follow-up physical and mental health composite scores remained below those observed in other patient populations throughout Africa, such as hypertensive patients (Ogunlana, Adedokun, Dairo, & Odunaiya, 2009); persons living with HIV (Mbada, Onayemi, Ogunmoyole, Johnson, & Akosile, 2013); and survivors of critical illness (Schneiderman, 2012). Although specific etiologies for the differences remain to be determined, many of the substance users in this cohort have experienced more negative effects on quality of life before starting methadone and have co-occurring mental health disorders requiring more than three to six months to properly address, as compared to patients who struggle with hypertension.

Significantly higher mean changes in PCS were observed among those who had previous poly-substance use with cocaine. In contrast, significantly lower mean changes in PCS were observed among clients who were living with HIV, satisfied with their current marital situation, had a history of suicidal thoughts, and had previous difficulty with understanding, concentrating or remembering things. Clients with shorter history of heroin use had significantly higher mean changes in MCS. Surprisingly, no baseline mental health characteristics were associated with change in MCS.

Concomitant use of heroin and cocaine has severe health and social consequences and can undermine the effectiveness of medication-assisted treatment (Condelli, Fairbank, Dennis, &

Rachal, 1991; Grella, Anglin, & Wugalter, 1997; F. Leri, Bruneau, & Stewart, 2003). Behavioral interventions such as substance abuse counseling and urine screening were implemented to address concurrent cocaine use. It is important to note that only a small proportion of clients reported concurrent cocaine use in the 30 days prior to methadone initiation (2%). When adjusted for other potentially confounding factors, MMT clients who reported previously using cocaine experienced significant improvements in physical health. Heroin and cocaine co-use has been documented in anecdotal and clinical evidence elsewhere, but the neurobiological mechanisms associated with co-use are not clearly understood (F. Leri et al., 2003; Francesco Leri et al., 2005). Prior research suggests that cocaine may alleviate some opioid withdrawal symptoms and that the subjective effects of cocaine are enhanced in opioid-dependent individuals. However, additional research is needed to fully understand the neurobiological effects of combined heroin and cocaine use and underlying factors associated with co-use and how those in turn affect quality of life.

Previous research indicates that marital status and social support are associated with better overall health and improved outcomes in drug users and hospitalized or chronically ill individuals (De Maeyer, Vanderplasschen, & Broekaert, 2009; DiMatteo, 2004; Dobkin, De, Paraherakis, & Gill, 2002; Kiecolt-Glaser & Newton, 2001; Nuwaha & Musinguzi, 2013; Preau et al., 2007; Rhoads, 1983). However, also important is the level of satisfaction with one's current situation (Kiecolt-Glaser & Newton, 2001). Satisfaction with current marital status was 83% among married individuals and only 39% for single or unmarried participants (data not shown). Satisfaction with current marital status was associated with higher baseline PCS scores (data not shown) in our cohort. However, when adjusted for other baseline factors, it was associated with lower mean change in physical health. These findings warrant additional investigation on the effects of marital status, personal relationships and social support on HRQOL and the physiological pathways between marital relationships to health outcomes.

Mental illness impacts quality of life, substance use severity, adherence to treatment, and overall success of treatment (Alonso et al., 2004; Brooner, King, Kidorf, Schmidt, & Bigelow, 2015; Evans, Banerjee, Leese, & Huxley, 2007). People who inject drugs often have comorbid psychiatric conditions that lead to impaired functioning and decreased well-being (Darke, Swift, & Hall; Kendler, Prescott, Myers, & Neale, 2003). This was apparent in our study population, in which 26% reported experiencing serious depression in the previous 30 days; 26% experienced serious anxiety in the last 30 days; 22% reported difficulty with understanding, concentrating or remembering; and 14% experienced visual or auditory hallucinations.

Attempted suicide and suicidal ideations present a significant clinical challenge in methadone maintenance programs, distinct from heroin overdose. Previous studies have also shown that substance abuse is one of the biggest risk factors for suicide risk (Borges et al., 2006; Harris & Barraclough, 1997; Joe, Stein, Seedat, Herman, & Williams, 2008; Wilcox, Conner, & Caine, 2004). Additional risk factors, including extensive polysubstance use, major depression, perceptions of belonging and burdensomeness, and sexual or physical victimization, are associated with higher risk of suicide and suicidal ideations among drug users (Bohnert, Roeder, & Ilgen, 2011; CSAT, 2008; Farrell, Neeleman, Griffiths, & Strang,

1996; Ilgen et al., 2010; Roy, 2001). In our study population, 10% of participants reported having suicidal thoughts and 3% had attempted suicide in the past. The enduring detrimental effect of mental health disorders, particularly suicidal thoughts, on the physical component score, was observed among methadone clients. These findings reinforce the critical need for a comprehensive approach to provide routine mental illness screenings, increased suicide risk assessment and appropriate treatment to address co-occurring conditions. In addition to diagnosis and treatment, an approach must focus equally on prevention.

Aspects of mental and physical health, risk behaviors and quality of life among drug users are intertwined and complex. In addition to improving HRQOL, retention in methadone can lead to reductions in HIV risk behaviors, less HIV transmission into the community, and improved adherence to HIV and TB medications, thereby reducing morbidity and mortality. In particular, methadone dose has been a critical factor in retaining clients in treatment and linking clients into additional health services (Bao et al., 2009; Sarasvita, Tonkin, Utomo, & Ali, 2012; Tran et al., 2015; Wang et al., 2012). Higher dosing of methadone is known to suppress withdrawal symptoms and provide greater opioid blocking abilities should heroin be ingested (Donny, Brasser, Bigelow, Stitzer, & Walsh, 2005; Donny, Walsh, Bigelow, Eissenberg, & Stitzer, 2002). Similar to other studies, higher doses of methadone were associated with significant short-term improvements in quality of life among out study cohort (Wang et al., 2012). It is important to keep in mind that individuals suffering from high substance dependence and/or with a long history of substance use are often initiated on higher doses of methadone.

Strengths of this study included the use of standardized clinical protocols and routine data sources. However, the study should be interpreted in light of some important limitations. Clients who dropped out of methadone treatment missed follow-up data limited the number of individuals included in the study. Due to limited sample size, we were unable to adequately examine interactions between baseline characteristics and HRQOL. In addition, the SF-12 allows calculation of only the summary scales for physical and mental health and not the subscales, which may contain other valuable information. Other limitations of this research included its observational nature and potential for unmeasured or mismeasured covariates to bias our results. In addition to examining statistical significance, it will be important to evaluate the magnitude of changes to establish the minimally important difference in HRQOL. This was not the primary focus of this study, but researchers hope that these data can help inform the growing field.

In conclusion, this study demonstrated the positive short-term effects of methadone treatment on health-related quality of life and highlights the importance of sustained retention in treatment for optimal benefits. However, comprehensive supportive services in addition to provision of methadone are needed to address the complex health needs of PWID. Regular screenings and health monitoring, with a focus on both prevention and treatment, among clients receiving methadone are fundamental to improving quality of life. Future research should examine the long-term effects of methadone on HRQOL.

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Table 1

Baseline Characteristics of Study Participants, n=288

		Physical Health Composite Score		Mental Health Composite Score	
		Yes*	No*	Yes*	No*
	n (%)	mean ± std dev	mean ± std dev	mean ± std dev	mean ± std dev
Demographics					
Age (years)					
≤25	15 (5)	39.33 ± 10.55	-	36.53 ± 8.86	-
26–35	183 (64)	37.89 ±10.20	-	37.91 ± 7.57	-
36–45	90 (31)	37.55 ± 10.13	-	39.60 ± 7.44	-
Male	260 (90)	37.89 ±10.25	37.61 ±19.60	38.24 ± 7.67	39.55 ± 7.14
Married	36 (13)	37.99 ± 10.63	37.84 ± 10.12	38.45 ± 7.75	38.35 ± 7.62
At least one child	93 (32)	37.24 ±10.57	38.16 ±9.99	38.51 ± 7.77	38.30 ± 7.57
Primary Level Education or Lower	162 (56)	39.07 ± 10.13	36.22 ± 10.04	38.18 ± 7.80	38.77 ± 7.23
Unemployed	157 (55)	38.97 ± 9.96	36.46 ± 10.29	38.24 ± 7.64	39.37 ± 7.07
Satisfaction with current living arrangements	238 (83)	38.97 ± 9.96	40.29 ± 10.89	38.31 ± 8.38	38.42 ± 6.66
HIV-positive	76 (27)	38.51 ± 10.16	37.76 ± 10.23	38.45 ± 7.25	38.30 ± 7.81
Drug Use History					
Years of heroin use, median (IQR)	10 (6, 15)	-	-	-	-
Poly-substance Use in Last 30 days					
Cocaine	5(2)	31.74 ± 11.99	37.97 ± 10.12	31.00 ± 5.50	38.50 ± 7.60
Alcohol	64 (22)	37.97 ± 10.29	37.83 ± 10.16	38.78 ± 8.22	38.25 ± 7.46
Benzodiazepine	39 (14)	35.84 ± 9.81	35.84 ± 38.18	38.10 ± 6.19	38.41 ± 7.83
Sexual Risk Factors					
Multiple Sex Partners in Last Six Months	55 (19)	36.65 ± 10.62	38.08 ± 10.03	38.55 ± 9.25	38.33 ± 7.22
Risky Sexual Behavior in Last Six Months	123 (43)	37.80 ± 10.21	37.81 ± 10.12	38.01 ± 6.93	38.64 ± 8.13
Injection Risk Factors					
Ever Used Flashblood	27 (9)	38.57 ± 8.71	37.73 ± 10.29	38.13 ± 7.26	38.40 ± 7.68
Shared Needles at Last Injection	43 (15)	36.46 ± 9.83	38.04 ± 10.20	36.50 ± 7.45	38.70 ± 7.63
Shared other Equipment at Last Injection	34 (12)	35.10 ± 8.77	38.17 ± 10.28	37.37 ± 6.57	38.51 ± 7.77

		Physical Health Composite Score		Mental Health Composite Score	
		Yes*	No*	Yes*	No*
	n (%)	mean ± std dev	mean ± std dev	mean ± std dev	mean ± std dev
Mental Health History					
Depression in Last 30 Days	75 (26)	36.02 ± 9.98	38.51 ± 10.18	38.37 ± 7.41	38.36 ± 7.71
Anxiety in Last 30 Days	76 (26)	35.86 ± 10.69	38.58 ± 9.90	38.62 ± 7.47	38.28 ± 7.69
Ever had Suicidal Thoughts	29 (10)	34.45 ± 10.45	38.24 ± 10.09	38.29 ± 7.51	38.38 ± 7.65
Ever Attempted Suicide	8 (3)	38.39 ± 11.90	37.85 ± 10.14	36.43 ± 8.80	38.42 ± 7.59
Ever experienced hallucinations	40 (14)	34.87 ± 9.24	38.34 ± 10.24	37.67 ± 7.76	38.48 ± 7.61
Cognitive difficulties	62 (22)	34.24 ± 10.52	38.85 ± 9.86	39.01 ± 7.31	38.19 ± 7.71
Trouble controlling aggression	16 (6)	32.95 ± 9.81	38.15 ± 10.13	38.14 ± 6.00	38.38 ± 7.71
Previous psychiatric treatment	10 (3)	36.94 ± 12.91	37.89 ± 10.08	36.50 ± 8.83	38.43 ± 7.58
Satisfaction with current marital status	119 (42)	39.91 ± 9.67	36.35 ± 10.32	38.53 ± 7.62	38.22 ± 7.68
History of Abuse					
Any History of Physical Abuse	34 (12)	36.99 ± 10.72	37.94 ± 10.11	38.09 ± 7.48	38.40 ± 7.67
Any History of Sexual Abuse	4 (1)	41.87 ± 11.49	37.82 ± 10.15	38.89 ± 4.08	38.36 ± 7.69
Criminal History					
Ever arrested	173 (60)	36.65 ± 10.21	39.68 ± 9.88	37.83 ± 7.29	39.17 ± 8.06
Methadone Dose at Initiation					
≥85 mg	23 (8%)	37.63 ± 10.86	37.88 ± 10.13	37.59 ± 9.31	38.43 ± 7.47

*For binary variables, the ‘Yes’ column includes people who meet the variable description; ‘No’ column includes clients who do not meet that description

Table 2

Univariate and Multivariable Regression Coefficients for Changes in Physical Health Composite Score

	Univariate Regression Coefficient (95% CI)	p-value	Multivariable Regression Coefficient (95% CI)	p-value
Demographics				
Age (years)				
≤25	(ref)			
26–35	3.76 (−2.34, 9.86)	0.636 *		
36–45	3.51 (−2.92, 9.95)			
Male	4.14 (−0.32, 8.59)	0.069		
Married	−0.76 (−5.79, 4.27)	0.766		
At least one child	1.2 (−1.82, 4.22)	0.435		
Primary Level Education or Lower	−1.53 (−4.45, 1.38)	0.302		
Unemployed	2.36 (−1.10, 5.82)	0.18		
Satisfied with current living arrangements	−2.95 (−5.78, −0.12)	0.04		
HIV-positive	−4.57 (−8.02, −1.13)	0.009	−3.84 (−6.27, 1.41)	0.002
Drug Use History				
Years of heroin use	−0.03 (−0.28, 0.22)	0.808		
Polysubstance Use (last 30d)				
Cocaine	9.03 (1.03, 17.03)	0.027	3.37 (0.16, 6.59)	0.040
Alcohol	0.41 (−3.02, 3.85)	0.813		
Benzodiazepine	2.17 (−2.0, 6.34)	0.307		
Sexual Risk Factors				
Multiple Sex Partners (last 6m)	−2.02 (−6.02, 1.99)	0.323		
Risky Sexual Behavior (last 6m)	−0.65 (−3.57, 2.28)	0.665		
Injection Risk Factors				
Ever Used Flashblood	−1.87 (−6.83, 3.08)	0.458		
Shared Needles at Last Injection	−2.37 (−7.13, 2.40)	0.329		
Shared other Equipment at Last Injection	−1.11 (−5.45, 3.23)	0.614		
Mental Health History				
Depression in Last 30 Days	1.58 (−1.91, 5.08)	0.373		
Anxiety in Last 30 Days	1.24 (−2.20, 4.68)	0.479		
Ever had Suicidal Thoughts	−2.42 (−8.08, 3.23)	0.4	−5.35 (−9.88, −0.82)	0.021
Ever Attempted Suicide	−5.98 (−18.93, 6.97)	0.364		
Ever experienced hallucinations	2.58 (−1.78, 6.94)	0.245	3.21 (−0.08, 6.50)	0.056
Cognitive difficulties	1.13 (−2.82, 5.07)	0.575	−4.29 (−7.64, −0.94)	0.012
Trouble controlling aggression	3.46 (−2.74, 9.65)	0.273		
Previous psychiatric treatment	−0.06 (−11.22, 11.11)	0.992		
Satisfied with current marital status	−4.73 (−7.63, −1.84)	0.001	−2.13 (−4.20, −0.05)	0.045
History of Abuse				
Any History of Physical Abuse	2.44 (−1.68, 6.57)	0.245		
Any History of Sexual Abuse	−6.07 (−17.37, 5.22)	0.291		

	Univariate Regression Coefficient (95% CI)	p-value	Multivariable Regression Coefficient (95% CI)	p-value
Criminal History				
Ever arrested	3.32 (0.56, 6.17)	0.023		
Methadone Dose at Initiation				
≥85 mg	1.40 (−2.48, 5.30)	0.478		

* test from group-linear term

Table 3

Univariate and Multiariable Regression Coefficients for Changes in Mental Health Composite Score

	Univariate Regression Coefficient (95% CI)	p-value	Multivariable Regression Coefficient (95% CI)	p-value
Demographics				
Age (years)				
≤25	(ref)			
26–35	−0.005 (−4.76, 4.75)	0.002 *		
36–45	−4.07 (−9.02, 0.88)			
Male	0.1 (−3.76, 3.95)	0.96		
Married	−0.62 (−4.18, 2.93)	0.731		
At least one child	−1.05 (−3.45, 1.35)	0.391		
Primary Level Education or Lower	1.38 (−0.9, 3.66)	0.235	1.04 (−0.50, 2.58)	0.184
Unemployed	0.97 (−1.88, 3.83)	0.503		
Satisfied with current living arrangements	0.41 (−1.90, 2.72)	0.725		
HIV-positive	−0.32 (−2.82, 2.17)	0.8		
Drug Use History				
Years of heroin use	−0.15 (−0.62, 0.23)	0.088	−0.16 (−0.30, −0.04)	0.012
Polysubstance Use in Last 30 days				
Cocaine	8.64 (−0.08, 17.36)	0.05		
Alcohol	−0.03 (−2.79, 2.73)	0.983		
Benzodiazepine	−1.13 (−4.48, 2.22)	0.506		
Sexual Risk Factors				
Multiple Sex Partners in Last Six Months	−1.1 (−4.14, 1.95)	0.479		
Risky Sexual Behavior in Last Six Months	0.74 (−1.56, 3.04)	0.528		
Injection Risk Factors				
Ever Used Flashblood	0.55 (−3.18, 4.28)	0.771		
Shared Needles at Last Injection	2.59 (−0.47, 5.64)	0.096		
Shared other Equipment at Last Injection	1.89 (−1.52, 5.31)	0.276		
Mental Health History				
Depression in Last 30 Days	−0.09 (−2.49, 2.31)	0.941		
Anxiety in Last 30 Days	−0.65 (−3.04, 1.75)	0.596		
Ever had Suicidal Thoughts	0.58 (−2.64, 3.80)	0.723		
Ever Attempted Suicide	2.56 (−4.33, 9.45)	0.466		
Ever experienced hallucinations	0.57 (−2.25, 3.40)	0.69		
Cognitive difficulties	−1.41 (−3.96, 1.13)	0.276		
Trouble controlling aggression	2.6 (−1.08, 6.27)	0.165	2.14 (−0.57, 4.84)	0.121
Previous psychiatric treatment	2.68 (−3.51, 8.88)	0.395	1.86 (−0.49, 4.21)	0.120
Satisfied with current marital status	−0.69 (−2.96, 1.59)	0.553		
History of Abuse				
Any History of Physical Abuse	0.56 (−2.76, 3.87)	0.741		
Any History of Sexual Abuse	1.2 (−4.45, 6.86)	0.676		

	Univariate Regression Coefficient (95% CI)	p-value	Multivariable Regression Coefficient (95% CI)	p-value
Criminal History				
Ever arrested	0.17 (−2.19, 2.54)	0.886		
Methadone Dose at Initiation				
≥85 mg	2.18 (−1.59, 5.95)	0.257	1.65 (0.17, 3.13)	0.028

* test from group-linear term