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ORIGINAL PAPER

Predictors of Successful HIV Care Re-engagement Among Persons Poorly Engaged in HIV Care

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Abstract

The Data to Care (D2C) strategy uses HIV surveillance data to identify persons living with HIV (PLWH) who are poorly engaged in care and offers assistance with care re-engagement. We evaluated HIV care re-engagement among PLWH in Seattle & King County, Washington after participation in a D2C program and determined whether variables available at the time of the D2C interview predicted subsequent re-engagement in care. We defined successful re-engagement as surveillance evidence of either continuous care engagement (≥ 2 CD4 counts or HIV RNA results ≥ 60 days apart) or viral suppression (≥ 1 HIV RNA < 200 copies/mL) in the year following the D2C interview. Predictor variables included client characteristics, beliefs about HIV care, and scores on psychosocial assessment scales. Half of participants successfully re-engaged in care. We did not find any significant predictors of re-engagement except viral suppression at the time of the D2C interview. Close follow-up is needed to identify which D2C participants need additional assistance re-engaging in care.

Keywords HIV care continuum · Retention in care · Data to care · Barriers to care · HIV surveillance

Introduction

Viral suppression among persons living with HIV (PLWH) is crucial for the health of individual PLWH and for preventing HIV transmission. However, an estimated 40% of HIV-diagnosed persons in the U.S. were not virally suppressed in 2015 [1]. Given that the majority of individuals who are on antiretroviral medications achieve viral suppression, lack of viral suppression in the overall population of PLWH stems largely from inadequate engagement in care. Regular engagement in HIV care is associated with earlier initiation of antiretroviral therapy, higher survival rates, and lower rates of transmission of the virus [2, 3].

While a substantial body of research has examined the factors that impact an individual's initial engagement in care, there remains a gap in understanding of what happens after someone falls out of care and what factors influence re-engagement in care. As HIV prevention efforts have evolved to focus on the HIV care continuum, the strategy of Data to Care (D2C) has emerged as a key public health HIV prevention approach [4]. Broadly, D2C refers to the use of HIV surveillance data to identify and re-engage out-of-care PLWH. Health departments use the results of laboratory-reported CD4 counts and viral loads to identify PLWH who appear to be poorly engaged in care based on a gap in reports or unsuppressed viral loads, contact them, and attempt to relink them to care. Public Health—Seattle and King County (PHSKC) implemented a countywide D2C program in 2012 [5, 6]. A controlled evaluation of that approach demonstrated that it was not effective in shortening the time to viral suppression [7].

One strategy that could improve the effectiveness of D2C and related efforts to improve HIV care engagement is earlier detection of individuals who are unlikely to re-engage in HIV care and earlier deployment of additional, more intensive interventions. In Seattle & King County, one such intervention is the Max Clinic, an alternative HIV care delivery model designed for high-need individuals with HIV who do

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not engage in traditional HIV medical care [8]. However, little evidence exists to guide earlier identification of individuals for more intensive HIV care engagement interventions. The objective of this study was to determine whether factors collected in the course of the D2C program in Seattle & King County predicted successful patient re-engagement in order to develop an evidence-based approach to identify individuals at high risk for persistent poor engagement who might benefit from earlier higher-intensity interventions.

Methods

Study Design, Setting and Population

This prospective cohort study included individuals with diagnosed HIV residing in King County, Washington who enrolled in PHSKC's D2C program, the Care and Antiretroviral Promotion Program (CAPP). The PHSKC surveillance team used HIV surveillance data to identify all individuals with a last known residence in King County who appeared to be poorly engaged in HIV care, defined as having no CD4 or viral load reported to surveillance for ≥ 12 months or a viral load of > 500 copies/mL at last report ≥ 6 months after HIV diagnosis. The methods of CAPP are described in detail elsewhere [5, 7]. Briefly, health department disease intervention specialists (DIS) contacted the last known medical provider for each eligible case then attempted to contact the individual PLWH and offer enrollment in CAPP. The baseline CAPP interview included a structured interview to assess barriers in care and development of an individualized plan to re-engage in HIV medical care. DIS assisted CAPP participants with re-engaging in care using a combination of health systems navigation, brief counseling, and referral to support services. All persons who participated in CAPP completed a computer-assisted self-interview (CASI) at the time of enrollment. This analysis includes all persons enrolled in CAPP between 3/2012 and 5/2016. The end date was selected to allow 12 months of follow-up observation time as of the date of data extraction for this analysis. From 10/2012 to 1/2014, DIS offered all CAPP participants the opportunity to participate in an exploratory study designed to assess several psychosocial factors in greater depth using validated measurement instruments administered by CASI (hereafter referred to as the 'psychosocial factors study'). CAPP was conducted as a public health activity that was not subject to IRB oversight. The University of Washington IRB approved the psychosocial factors study.

Outcome Definitions

We used HIV surveillance data routinely reported to the health department to assess the outcome for this study, which was successful re-engagement in HIV care, defined as evidence of either continuous care engagement or viral suppression in the 12 months after the initial D2C encounter. Our rationale for including viral suppression, regardless of care engagement, in the definition of successful engagement is that viral suppression is the central goal of both clinical care and public health efforts to improve the HIV care continuum. We also included continuous care engagement, regardless of viral suppression, in the outcome definition because assisting patients with care re-engagement was the immediate goal of the D2C intervention. We reasoned that future public health interventions to deliver earlier more intensive support would prioritize individuals who were unlikely to re-engage in care or reach viral suppression. We defined viral suppression as ≥ 1 HIV RNA < 200 copies/mL and, using laboratory results as proxy measures for HIV care visits, continuous care engagement as ≥ 2 CD4 count or HIV RNA results ≥ 60 days apart. The latter measure aligns with the DHHS consensus metric for HIV care engagement [9]. Participants with no viral load results reported to surveillance were considered to be not virally suppressed.

Predictor Variables

We selected all variables included in this analysis a priori based on demonstrated or hypothesized associations with engagement in HIV care, adherence to antiretroviral therapy or viral suppression. Our approach was informed by the Blueprint for HIV Treatment Success published by Ulett and colleagues, a theoretical model that includes a number of patient characteristics associated with HIV care outcomes [2]. We used data from the CASI to define participant characteristics, including age, race/ethnicity, gender, country of birth, level of education, income, housing status, and health insurance. For the analysis, we categorized housing as "stable" (owning or renting an apartment or house), "unstable" (e.g. staying with friends or other transitional housing), or "homeless." We assessed health insurance as a dichotomous variable (yes/no) or unknown. We used surveillance data to define HIV transmission risk factor, categorized according to CDC surveillance criteria. We defined each client's viral suppression status and CD4 stratum at the time of the CAPP interview. Individuals who met criteria for CAPP at the time of data extraction from surveillance, but had a suppressed viral load reported in the interim between initial data extraction and the baseline CAPP interview, are described as "suppressed at baseline" for this analysis.

We compared the demographic characteristics of CAPP participants to the overall population of PLWH in King County using data from HIV surveillance through the end of 2015, and education and income data from King County from the 2013 to 2014 cycles of the Medical Monitoring Project (MMP) in King County [10]. The MMP is a CDC

surveillance project that ascertains education and income through survey questions administered during individual interviews and weights the data to adjust for the probability of non-response [11].

The CAPP interview assessed substance use by asking about lifetime and past year use of methamphetamine, heroin, crack, or cocaine and, for alcohol, the number of days in the past month during which the participant had ≥ 1 drink and, separately, ≥ 5 drinks. For this analysis, we defined substance use as having used any illicit substance in the past 6 months or meeting the Substance Abuse and Mental Health Services Administration (SAMHSA) definition for heavy drinking (≥ 5 drinks on the same occasion on ≥ 5 or more days in the last month). We evaluated depression with the Whooley depression screen, which asks if one has felt "down, depressed, or hopeless" or "been bothered by little interest or pleasure in doing things" often in the past month [12, 13]. A positive screen was defined by affirmative answers to one or both questions.

The CAPP survey assessed barriers to care by asking participants to define each potential barrier as important or not important to them. For this analysis we focused on attitudes and beliefs that we hypothesized could pose substantial barriers to engagement, including, "I'm not sure I'm really HIV positive," "At least for now, I think I can control my HIV with a healthy attitude and healthy living," "I don't want to see a conventional medical doctor, I prefer alternative therapies," "I prefer alternative therapy to taking ART," "I believe that God is helping me with my HIV, and that for now that is enough," and "I don't think seeing a medical doctor for HIV would help me".

The psychosocial factors study survey included validated scales to assess social support, self-efficacy, impulsivity, HIV and sexual minority stigma, and substance use in coping. Each of these factors has been demonstrated or hypothesized to be associated positively or negatively with engagement in HIV care in prior studies with the exception of impulsivity [14–19], which we included due to its association with methamphetamine use [20], a common risk factor for poor HIV care continuum outcomes in King County [21]. Social support was assessed using 18 items from the Medical Outcomes Study—Social Support (MOS-SS) survey [22]. We adapted the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES) [23] to assess self-efficacy for adhering to HIV medical care, replacing statements about medication adherence with medical visit adherence. We used the Grasmick Self-Control Scale to assess impulsivity [24]. The HIV stigma items come from a subset of the Stigma Scale for Chronic Illness used to evaluate HIV stigma [25]. The first part is adapted from a scale previously created to measure HIV stigma, resources, and disclosure [26, 27]. We included two additional questions regarding the participants' perceived level of acceptance from their community regarding their sexual identity and their own personal level of acceptance for themselves; these questions were scored separately. We adapted a question from the Brief COPE instrument to assess the use of alcohol or drugs to cope with the stress of living with HIV/AIDS [28]. The scores for each factor were calculated as the average of each participant's scores to all items in each scale.

Statistical Analysis

We compared the characteristics of CAPP participants and the overall population of PLWH using Chi square analyses with a statistical significance level of $p < 0.05$. We examined the association between care engagement and predictor variables using Chi square tests. In a post hoc sensitivity analysis, we analyzed different categorizations of substance use and housing as well as viral suppression at baseline and a combination of substance use, unstable housing, and/or positive depression screen. We approached the analysis of the PSF study variables as an exploratory one because the study did not recruit a sufficient proportion of the CAPP participants to achieve adequate representation. We used a Wilcoxan rank-sum test to examine the association between those PSF and care re-engagement. We used Stata version 15 (Cary, NC) for all analyses.

Results

A total of 408 persons participated in CAPP and completed a D2C interview during the analysis period. Table 1 presents the characteristics of the study population. The majority of participants were men (86%) and non-Hispanic white (53%) or non-Hispanic black (21%). The most common HIV transmission risk category was men who have sex with men (MSM). Most of the study participants (59%) earned < 139% of the federal poverty level (FPL) for a household of one [29]. Of the 408 participants, 109 (27%) completed the PSF study survey. During the time period in which all CAPP participants were offered the PSF survey, 148 of the total 408 completed a D2C interview and 109 of the 148 completed a PSF survey. The characteristics of the participants who completed the psychosocial factors survey did not differ significantly from the overall population of CAPP participants.

Compared to the total population of PLWH in King County, CAPP participants were younger (25% vs. 15% < 34 years; p value for age distribution < 0.001), less likely to have post-secondary education (62% vs. 70%; education distribution $p = 0.009$), and lower income (59% vs. 42% < 139% FPL; income distribution p-value < 0.001). A higher proportion of CAPP participants had injection drug use as a transmission risk factor at the time of HIV diagnosis (31% vs. 12%, including MSM-IDU; $p < 0.001$). As intended

Table 1 Demographic and baseline characteristics of study population (N = 408) compared to overall county population of people living with HIV (N = 7071)

	CAPP participants (N = 408) N (%)	Overall county population of PLWH (N = 7071) N (%)[a]	P-value (Chi square test)
Gender			0.49
Male	350 (86)	6189 (88)	
Female	53 (13)	823 (12)	
Transgender/nonbinary	5 (1)	59 (1)	
Age (years)			< 0.001
< 34	100 (25)	1052 (15)	
35–44	117 (29)	1542 (22)	
45–54	144 (35)	2523 (36)	
> 55	45 (11)	1954 (28)	
Missing	2 (1)	0 (0)	
Race			< 0.001
Non-Hispanic White	217 (53)	4280 (61)	
Non-Hispanic Black	86 (21)	1328 (19)	
Hispanic	69 (17)	914 (13)	
Other	31 (8)	549 (7)	
Missing	5 (1)	0 (0)	
Country of birth			0.036
United States	346 (85)	(82)	
Not United States	58 (14)	(18)	
Missing	4 (1)	(0)	
HIV transmission risk factors			< 0.001
MSM	225 (55)	4745 (67)	
MSM + IDU	85 (21)	596 (8)	
IDU	39 (10)	302 (4)	
Heterosexual with presumed positive partner	30 (7)	702 (10)	
Other	2 (0.5)	74 (1)	
Missing	1 (0.3)	0 (0)	
No identified risk	26 (6)	652 (9)	
Viral suppression status[b] (copies/mL)			< 0.001
Suppressed (< 200)	54 (13)	(81)	
Not suppressed (≥ 200)	152 (38)	(9)	
Missing	202 (50)	(10)	
CD4 count (cells/μL)			< 0.001
≥500 (stage 1)	55 (13)	(56)	
200–499 (stage 2)	104 (25)	(28)	
< 200 (stage 3)	43 (11)	(6)	
Missing	206 (50)	(10)	
Education[c]			0.01
Less than high school	53 (13)	(11)	
High school diploma orGED	96 (24)	(19)	
Some college, associates, or vocational	183 (45)	(70)	
College graduate or more	70 (17)		
Missing	6 (1)	(0)	
Income[d] relative to FPL			< 0.001
< 139%	241 (59)	(42)	
139–400%	123 (30)	(31)	
More than 400%	31 (8)	(26)	
Missing	13 (3)	(0%)	

[a]Values reported with just a parenthesis represented weighted percentages not associated with an absolute number

[b]Based on last report to surveillance during the 12 months prior to encounter

[c]Based on King County Medical Monitoring Project (MMP) report from 2013 to 2014, the most recent report available at the time of data analysis

[d]Income categories used in the CAPP Baseline Survey were categorized to align with federal poverty levels as reported in MMP, based on 2013 Federal Poverty Level Guidelines

by the design of the CAPP D2C program, participants had a significantly lower proportion with viral suppression (13% vs. 81%; $p < 0.001$) and were more likely to be missing laboratory data in surveillance for ≥ 12 months (50% vs. 10%; $p < 0.001$) than the overall population of PLWH in King County.

Of the 408 CAPP participants, 204 (50%) successfully re-engaged in HIV care in the 12 months after the initial CAPP encounter. Of these, 137 (67%) met criteria for both continuous care engagement and viral suppression, 48 (24%) were continuously engaged in care but not virally suppressed, and 19 (9%) were virally suppressed but not continuously engaged in care. Table 2 shows care re-engagement stratified by the predictor variables. Substance use, unstable housing, and positive depression screen were not associated with the likelihood of care re-engagement; nor was health insurance or agreement with statements we defined as "belief barriers." In the sensitivity analysis, no combination of substance use, unstable housing and/or positive depression screen was significantly associated with re-engagement in care ($p = 0.43$). The only variable significantly associated with re-engagement was having reached viral suppression by the time of the CAPP interview ($p < 0.001$).

Results of the exploratory analysis of factors assessed in the PSF study are summarized in Table 3. Persons who re-engaged in care reported somewhat higher levels of social support compared to those who did not [median 3.0 (IQR 2.0–3.5) vs. 2.2 (IQR 1.6–3.4)) on a scale of 0–4; $p = 0.09$]. For all other factors, the median and distribution of scores for each of the factors was similar among individuals who subsequently re-engaged in care and those who did not.

Discussion

In this study of all participants in a countywide D2C program over approximately 4 years, only 50% successfully re-engaged in care in the year following the initial D2C encounter and none of the factors assessed in the baseline D2C interview predicted care re-engagement. The only factor we

Table 2 Successful re-engagement by 12 months among CAPP participants, stratified by participant characteristics, and the association of characteristics with care re-engagement (N = 408)

	Overall N (%)	Successfully re-engaged within 12 months N (%)	Not successfully re-engaged within 12 months N (%)	P-value (Chi square)
Overall population	408 (100)	204 (50)	204 (50)	
Substance use				0.62
Yes	175 (43)	90 (44)	85 (42)	
No	233 (57)	114 (56)	119 (58)	
Unstable housing				0.98
Yes	114 (28)	58 (28)	56 (27)	
No	294 (72)	146 (72)	148 (73)	
Depression screen				0.75
Positive	281 (69)	139 (68)	142 (70)	
Negative	127 (31)	65 (32)	62 (30)	
2 or more of above 3				0.43
Yes	186 (46)	89 (44)	97 (48)	
No	222 (54)	115 (56)	107 (52)	
Health insurance[a]				
Yes	297 (73)	148 (73)	149 (73)	0.92
No	93 (23)	46 (23)	47 (23)	
Any belief barrier[b]				0.61
Yes	149 (37)	72 (35)	77 (38)	
No	259 (63)	132 (65)	127 (62)	
Viral suppression at baseline				<0.001
Yes	54 (13)	46 (23)	8 (4)	
No	354 (87)	159 (77)	192 (96)	

[a]18 of the responses to the insurance question were "don't know" or missing

[b]Include uncertainty about HIV diagnosis, belief in controlling HIV without ART, belief that a doctor would not help, and preference for alternative treatments over conventional HIV care and antiretroviral treatment (ART)

Table 3 Association between variables measured in the psychosocial factors survey and engagement in HIV care among data to care participants (N = 109)

	Median score, not engaged (IQR)	Median score, reengaged (IQR)	P values (Wilcoxan rank sum)
Social support (0–4 scale)	2.2 (1.6, 3.4)	3.0 (2.0, 3.5)	0.090
Self-efficacy (0–3 scale)	2.5 (2, 2.8)	2.6 (2.1, 2.9)	0.31
Impulsivity (0–3 scale)	1.0 (0.5, 2.0)	1.3 (0.5, 2.0)	0.91
HIV stigma (0–3 scale)	1.4 (0.8, 2.2)	1.2 (0.6, 1.8)	0.41
Sexual minority stress (0–3 scale)	0.6 (0.0, 1.4)	0.4 (0.1, 1.0)	0.63
Personal acceptance (0–4 scale)	3.0 (0.0, 4.0)	3.0 (0.0, 4.0)	0.71
Community acceptance (0–4 scale)	4.0 (3.0, 4.0)	4.0 (3.0, 4.0)	0.93
Substance use in coping (0–3 scale)	1.0 (0.0, 3.0)	1.0 (0.0, 2.0)	0.53

identified as predicting successful engagement in the year after the CAPP interview was having already reached by viral suppression by the time of the CAPP interview. The results of our exploratory analysis support the idea that social support is associated with successful care re-engagement, though this is not a conclusive finding.

The key strength of our study is that it was a pragmatic, population-based study in the context of a county-wide D2C program. This allowed us to gather data from a relatively large number of poorly engaged PLWH, and ensured that the analysis population represented PLWH participating in a "real-world" public health program. Considerations of sample size have little relevance in this setting because, rather than taking a random sample, we attempted to enroll all eligible individuals in King County. However, since this study was done in a single geographic location, the generalizability of our findings is uncertain.

Most existing literature on the topic of HIV care engagement focuses on the general population of PLWH or clinic populations. Substance use disorders, mental illness, and unstable housing are clearly associated with poor engagement in care [14]. There are several reasons why we may not have observed an association between these factors and care re-engagement in this study. First, the analysis population included only people who had already disengaged from care, a population in which substance use, housing and depression are common. This population differs substantially from general populations of PLWH. Second, the CAPP instrument may not have adequately captured some of the factors we examined, particularly substance use and depression. Third, our study was limited to individual barriers to care, and did not assess contextual, structural, and health systems barriers, which could influence an individual's likelihood of re-engaging in care. The barriers for people who do not regularly access HIV care are likely more complex than the individual factors that health departments routinely measure. Social support has been demonstrated to be associated with HIV care engagement in a recent study and is worthy of additional study for predicting care re-engagement among poorly engaged PLWH [30].

These results highlight the need to develop new approaches to re-engage PLWH in HIV care. Public health departments conducting D2C work need pragmatic, scalable, evidence-based ways to identify individuals who are unlikely to re-engage in care without additional intervention. Based on our findings, we streamlined the CASI for the Seattle & King County D2C program to include a shorter survey focused on factors essential for developing a re-engagement plan for each participant. Until we are able to identify factors that meaningfully predict re-engagement in care, our program's approach to identifying high need PLWH who need more intensive re-engagement assistance is to more closely monitor re-engagement and viral suppression following the D2C encounter.

In summary, we found no significant associations between re-engagement in HIV care and individual-level factors captured in an interview among participants in a health department D2C program, though results of an exploratory analysis suggest that social support may be associated with successful re-engagement. Effective models for population-based approaches to re-engaging out-of-care PLWH are needed, and methods to stratify the risk of failure to re-engage out-of-care PLWH could inform differentiated service delivery that provides more intensive interventions to individuals at higher risk for persistent poor engagement.

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Compliance with Ethical Standards

Conflicts of interest JCD has conducted research unrelated to this work supported by grants to the UW from the following companies: Hologic, Curatek Pharmaceuticals, ELITech and the Quidel Corporation. All other authors report no conflicts of interest.

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