

Level of Burden, Service Use Patterns, and Retention in Services in 10 Adolescent HIV Care Models

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ABSTRACT

Recently, there has been interest in clients with co-occurring problems, or “multiple” diagnoses. Of particular interest is the triple diagnosis of HIV status, substance abuse, and mental health problems. This paper examines whether youth with co-occurring disorders have differential service utilization patterns from those not identified as such. Level of therapeutic burden is defined as the number and severity of significant problems, including being HIV-positive, abusing drugs, and having a mental health problem. In addition, more sophisticated models assess whether service use patterns and retention characteristics are related to specific problem patterns. Data collected from 3,732 youth in 10 national demonstration projects are used to test these models. While it is necessary to know the pattern of diagnosis in predicting the types of services used, overall program retention can be predicted from knowing the number of such diagnoses. The projects were funded by the Health Resources and Services Administration (HRSA) HIV/AIDS Bureau (HAB), Special Projects of National Significance (SPNS) Program.

KEY WORDS: HIV; substance abuse; mental health; youth; service utilization.

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INTRODUCTION

Prior studies have shown that individuals living with HIV are at high risk for mental illness (e.g., Carey, Carey, and Kalichman, 1997; Hoff, Beam-Goulet, and Rosenheck, 1997). Likewise, persons with psychiatric disorders are at high risk for HIV infection, largely due to high rates of HIV risk behaviors (e.g., Carey, Weinhardt, and Carey, 1995; Coverdale, 1996; Kelly, Murphy, Sikkema, Somlai, et al., 1995). Estimates of the prevalence of HIV infection among psychiatric populations vary widely, ranging from approximately 5 to 20 percent (e.g., Cournos and McKinnon, 1997; Krakow, Galanter, Dermatis, and Westreich, 1998; Rabkin, 1996). Methodological constraints, however, are likely to yield underestimates of the actual rate of HIV seropositivity in this population (Kalichman, Carey, and Carey, 1996).

In terms of services to multiply-diagnosed populations, a number of programs have focused on HIV prevention for persons with mental disorders (e.g., Kalichman, Sikkema, Kelly, and Bulto, 1995) and in substance abusing populations (e.g., De Leon, 1996). Many in the field have advocated for comprehensive, integrated treatment programs for persons multiply-diagnosed with HIV, substance abuse, and/or mental illness (e.g., McCarty, La Prade, and Botticelli, 1996; McKinnon, Carey, and Cournos, 1997) and for continuing care components post “completion” of treatment (e.g., Cavaiola, Schiff, and Kane-Cavaiola, 1990). Services to multiply-diagnosed adolescents in particular need to incorporate the young person’s family, community, and culture (Gregorius and Smith, 1991). Clinicians working in the HIV field need to have expertise with mental health and substance abuse issues, as well as those related to HIV (Havens, Mellins, and Pilowski, 1996), although it has been noted that mental health and substance abuse treatment providers may be somewhat reluctant to address HIV-related issues

without appropriate cross-training (Dow and Knox, 1991). Services to multiply-diagnosed individuals are often fragmented, and depending on how the individual accesses the service system, concomitant health or psychosocial problems may go undiagnosed, misdiagnosed, or untreated (Levin, Trumble, Edmunds, Statman, et al., 1993).

One aspect of the prevalence of HIV among substance abusers is that over the years, the substance abuse treatment system has changed to address HIV-related issues. Comprehensive service models for substance abusers have been developed, which incorporate medical (e.g., Selwyn, 1996a; Herman and Gourevitch, 1997) and psychosocial (e.g., Sorensen and Miller, 1996) elements, although it has been noted that it is a false dichotomy to separate medical and psychosocial issues in this population (Selwyn, 1996b). It can be especially difficult to obtain the desired outcomes in treatment programs for multiply-diagnosed individuals. For example, among injection drug users in substance abuse treatment, psychiatric co-morbidity has been associated with poorer outcomes for both substance abuse and HIV-related outcomes (Batki, Ferrando, Manfredi, London, et al., 1996), and with poorer adherence to medical treatment (Sorenson, Mascovich, Wall, DePhilippis, Batki, and Chesney, 1998). However, successful treatment outcomes with this population have been demonstrated when patients are sufficiently engaged and actively participate in their care (e.g., Lyketsos, Fishman, Hutton, Cox, Hobbs, Spoler, Hunt, Driscoll, and Treisman, 1997).

More generally, increasing attention has been paid to patterns of dual diagnosis or co-occurring disorders (Ross, Glaser, and Germanson 1988; Regier, Farmer, Rai, Locke, Keith, Judd, and Goodwin, 1990; Zeidonis, Rayford, Brett, Bryant, and Rounsaville, 1994) throughout the medical and substance abuse treatment literature. Generally, individuals with co-morbid substance abuse or dependence and psychiatric disorders have a poor prognosis (Drake, Alterman, and Rosenberg, 1993), perhaps because they often may come to treatment depleted of

resources (unemployed, in financial difficulty, homeless), or they may receive insufficient doses of treatment (Lidz and Platt, 1995; Alterman, McLellan, and Shifman, 1993). Not surprisingly, clients with triple diagnoses (including substance abuse, mental illness, and cognitive impairment) were found to have higher rates of homelessness, legal problems, and histories of non-compliance with treatment compared with singly or dually diagnosed individuals (Strain, Buccino, Brooner, Schmidt, et al., 1993). It is possible that such clients may have such severe symptoms of mental illness, substance abuse, or cognitive impairment that they cannot participate completely in treatment.

Recently, it has been suggested that multiply diagnosed individuals may not be able to withstand the burden of integrating different clinical approaches utilized to treat their substance abuse and psychiatric conditions (Lidz and Platt, 1995). An expanded concept of level of burden was used to investigate the impact of multiple problems and disorders experienced by women in a substance abuse treatment program. Level of burden was defined as the number and severity of problems, such as psychological problems, cognitive impairment, chronic health problems, HIV/AIDS status, or substance abuse, experienced by the women themselves, as well as by staff and community. Treatment outcomes were found to be negatively correlated with the women's burden levels. Also, analysis of retention patterns indicated that early in the course of treatment, women with high burden levels tend to be at the highest risk for early termination (Brown, Huba, and Melchior, 1995).

Exploring the level of burden from the client perspective is important for several reasons. First, individuals with three or four disorders, such as drug and/or alcohol abuse, mental illness, cognitive impairment, HIV/AIDS, and other health problems, experience continuous challenges to their self-esteem from the negative images and the social stigma associated with the illnesses. Second, understanding the level of burden on the client may help care-giving staff understand

how to intervene when the client exhibits “noncompliance” with treatment or a poor connection with treatment providers. Third, this understanding can also contribute to the development of interventions to help staff, family members, and the larger community.

Multiply-diagnosed youth. Although a fair amount has been written about adolescents dually diagnosed with concomitant substance abuse and mental health problems, and about young people and HIV, relatively little has addressed the specific issues facing youth multiply-diagnosed with HIV, substance abuse, and/or mental disorders. One of the few articles to focus on HIV and multiple disorders among youth reported that adolescents with psychiatric disorders – much as their adult counterparts – are at very high risk for HIV infection (Brown, Dandovsky, Lourie, DiClemente, and Ponton, 1997).

In terms of the dual problems of substance abuse and mental illness among adolescents, specific multidisciplinary treatment models have been developed to work with this population (e.g., Chatlos, 1989; Griffin-Shelley, Sandler, and Lees, 1992; Kempton, Van Hasselt, Bukstein, and Null, 1994). In addition, the need to screen adolescents in mental health services for substance abuse issues has been advocated (Piazza, 1996). Mental disorders are thought to usually precede substance abuse problems, but the etiology may also be the converse (e.g., Gregorius and Smith, 1991; Stowell, 1991). Concomitant diagnostic problems among substance abusing adolescents include attention deficit disorder, learning disabilities, depression, and diagnoses related to being the victim of child abuse (Schiff and Cavaiola, 1988, 1990). Dual diagnosis in young people is likely to be under-diagnosed (Rivinus, 1988).

Even without specifically addressing issues of HIV disease, dually diagnosed adolescents are a very difficult population to treat. Such youth are admitted to treatment more frequently and are more difficult to retain in treatment than youth without multiple diagnoses (Pierce, 1991). Specific diagnoses may be related to differential patterns of retention in care; among hospitalized

dually-diagnosed youth, those who completed treatment were diagnosed with conduct disorders (Kaminer, Tarter, Bukstein, and Kabene, 1992). In general, treatment of persons living with HIV with concomitant personality disorders is very resource intensive (Golding and Perkins, 1996). In addition, dually-diagnosed adolescents require longer and more intensive treatment to obtain desired outcomes (e.g., sobriety), and that short-term, low intensity treatment programs are likely to be insufficient (Griffen-Shelley, Sandler, and Cameron, 1991).

A National Demonstration Program for Adolescent Care Projects

Through its Special Projects of National Significance (SPNS) Program, the HIV/AIDS Bureau of the Health Resources and Services Administration (HRSA funds national demonstration projects for HIV/AIDS care. In 1993, HRSA awarded 10 grants to projects targeting HIV/AIDS services to adolescents and youth. These 10 projects were relatively heterogeneous in that their programs range greatly in scope and planned outcomes. Nonetheless, the 10 projects shared target populations, specifically, adolescents and young adults who are either already living with HIV, or at high risk to become so, and they aimed to build programs with the potential for replication throughout the United States. A cross-cutting evaluation was developed to track the characteristics of the programs and their outcomes.

As to be expected for a national services demonstration program, the 10 HRSA SPNS Program Adolescent Care Grantees differ greatly from one another. Descriptions of the service models for the 10 adolescent care projects are given in a special issue of the Journal of Adolescent Health (see Huba and Melchior, 1998, and Woods, 1998, for an overview of the 10 models). In that issue there are articles describing the programs at: Bay Area Young Positives, a San Francisco program by youth with HIV for youth with HIV (Bettencourt, Hodgins, Huba, and Pickett, 1998); Children's Hospital of Boston (Woods, Samples, Melchiono, Keenan, Fox, Chase, Tierney, Paradise, O'Brien, Mansfield, Brooke, Allen, and Goodman, 1998), a comprehensive

health services continuum; Childrens Hospital Los Angeles (Schneir, Kipke, Melchior, and Huba, 1998), a comprehensive health services continuum with a special emphasis on social services; the Greater Bridgeport Adolescent Pregnancy Project (Feudo, Vining-Bethea, Shulman, Shedlin, and Burleson, 1998), a Connecticut street outreach project designed to move youth into HIV testing services; Health Initiatives for Youth (Bourdon, Tierney, Huba, Lothrop, Melchior, Betru, and Compoc, 1998), a San Francisco advocacy program for youth services; the Indiana Department of Health (Wright, Gonzalez, Werner, Laughner, and Wallace, 1998), a program with outreach and social support services to gay and lesbian youth in Indiana; the University of Alabama at Birmingham (Sturdevant, Kohler, Williams, and Johnson, 1998), an outreach and education program for at-risk young women outside Birmingham, Alabama; the University of Minnesota Youth and AIDS Projects (Remafedi, 1998), a hybrid university and community-based organization whose mission is to prevent HIV infection in youth at risk and to care for youth living with HIV in Minnesota through services, research, and teaching; Walden House (Hymel and Greenberg, 1998), a residential substance abuse facility in San Francisco; and YouthCare (Tenner, Trevithick, Wagner, and Burch, 1998), a Seattle program bringing services to runaway, homeless and sexual minority youth in venues where they congregate. All of the programs provide case management to young people. Whether or not the projects are directly providing tightly-linked systems of medical and psychosocial care, each is seeking to direct youth into such service models (Huba and Melchior, 1998). A number of the projects specifically target youth with multiple therapeutic issues (i.e., HIV, substance abuse, mental health problems), and many identify such youth through outreach.

This paper examines the various burdens, or problems, that individual youth have that potentially impact or predict service utilization patterns, including the length of time that they can be retained in a program. Adolescents living with HIV, or at high risk to acquire it, are at a

volatile time in their lives. As indicated from the research literature, and in earlier work with the data from these 10 projects, there is a multiplicity of needs evinced by the clients in these programs. These include: acquiring stable housing; dealing with substance abuse and mental health issues; coping with a diagnosis of HIV infection or learning that their behaviors can lead to later HIV infection; learning how to engage in safer sex practices both through using latex protection and negotiating with a partner to use such measures; participating in survival sex or other abusive sexual relationships; discovering one's sexual and other self identity; engaging in educational and vocational training; and, adhering to recommended medical treatments. Within such a context, the key goals of all of the 10 adolescent care projects have been to engage youth in attractive, relevant, and quality services and to keep them returning to those services in order for them to deal with the multiple issues each individual brings to the door. Youth with co-occurring disorders bring multiple problems to these projects, and it is a key challenge for the projects to provide such youth with the full array of needed services.

METHOD

Cross-Cutting Evaluation Instruments and Design

As part of their involvement as grantees, the 10 projects participated in a cross-cutting evaluation.¹⁶ The cross-cutting evaluation included several single-page forms. These forms utilize a fax-in system that allows data to be transmitted from project sites in the field to a central data computer (Huba, Brown, and Melchior, 1995; Huba and Melchior, 1995). The data presented in this paper were collected using the Contact Form (Huba, Melchior, and the HRSA SPNS Program Adolescent Care Projects, 1994) and the Intervention Form (Huba, Melchior, and

¹⁶ The cross-cutting evaluation is coordinated by The Measurement Group and was developed in collaboration with the 10 adolescent care projects and HRSA. These forms are available in various reports on these projects (Huba et al., 1997 a, b, c) and are also available on the Internet (www.themeasurementgroup.com/adolspns/adolspns.htm) along with full instructions for their use.

the HRSA SPNS Program Adolescent Care Projects, 1994). Contact Forms document characteristics of individuals reached by the adolescent care projects, including demographic characteristics and patterns of HIV risk. The forms may be completed in the context of outreach, program enrollment, or to change or update information previously documented for individuals served by the projects. Analyses forming client characteristics indicators are presented elsewhere (Huba, Melchior, Panter, Lee, Woods, Hodgins, Wright, Feudo, Goodman, Tierney, Schneur, Tenner, Remafedi, Greenberg, Sturdevant, Wallace, Brady, Singer, and Marconi, under review). Intervention Forms record services provided to an individual who is formally enrolled in care. This form codes services provided during the encounter, who provided the services, referrals made, and topics discussed. Analyses used to form the indicators of service intervention characteristics are similarly presented elsewhere (Huba, Melchior, Panter, Feudo, Schneur, Trevithick, Wright, Martinez, Woods, Sturdevant, Remafedi, Greenberg, Tierney, Wallace, Goodman, Tenner, Marconi, Brady, and Singer, under review). Although each of the adolescent care projects has its own service delivery model, the cross-cutting evaluation was designed for implementation across the ten projects. In general, the single-page data collection forms are completed at the time of each contact or service encounter, or shortly afterwards. Because service episodes are tracked across time, the utilization of various services provided by the projects and referrals made within and outside of those networks are tracked for as long as the youth is seen by the program.¹⁷

Method of Theory-Testing Regression Analysis

¹⁷ Human Subjects Protection Committees at each site determined if informed consent for participation in the evaluation was required or if the data were collected as part of the usual quality improvement process and, hence, exempt. All data collection at all sites was voluntary for clients and providers; therefore, these data do have certain non-random patterns of missing observations.

Regression, (whether used in the variations of linear regression, logistic regression, or Cox [survival analysis] regression), is a method of determining which variables predict a “dependent” or target variable. In the case of this article, multiple linear regression methods are used to study how many services are used, and “event history,” or survival analysis methods using Cox regression, are used to predict the retention of the client in the program.

Regression analysis in all of its different forms, can be used in two different ways. In one type of analysis, variables of interest are put together to see which independent variables predict a dependent measure. This is “exploratory” regression analysis. In the alternative use of regression employed in this paper, we have a basic theoretical (data) model in mind before we start the analyses and regression techniques are used to test the model. This second way of conducting regression analyses is usually preferred if either a “strong” or a “weak” theory can be specified. This paper starts with a basic conceptual model for each analysis. The regression analyses (described below) follow directly from the conceptual model described below.

Statistical models. A series of hierarchical planned setwise multiple linear regression models were tested to examine the effects of various indicators on service utilization rates. Program retention was studied with Cox regression and Kaplan-Meier survival analysis methods. To differentiate these conceptually related methods, survival analysis is a way of looking at the curve of how many clients are retained in a particular state (in this case, in the state of being treated by the program) after a certain number of days. The resulting analysis is the “survival curve.” Fairly straight-forward techniques contrast whether clients of one kind or another tend to be retained in the program longer. These methods are usually called “survival analysis” and the estimation method of Kaplan and Meier is the one typically employed, especially when there are a limited number of factors thought to influence program retention or survival. Cox regression, or event history analysis, may be thought of as an extension of survival analysis in which the

tendency of the client to stay in the program is predicted from a number of factors considered simultaneously. In general, Cox regression is an analog to usual forms of multiple linear regression where the dependent variable is time duration. In this paper, we first present survival curves using Kaplan-Meier analysis and then follow these analyses with Cox regression to test a more sophisticated model of the influences on time in program. It is very important to note that the Kaplan-Meier analyses specifically do not correct for the differences among programs while the Cox regressions do so by explicitly partialling out both the effects of being at a particular site and differences in the total number of intervention events.

Conceptual Model for the Analyses

The regression analyses in this paper (both linear and Cox regressions) test two alternate models. Both models examine the effects of client characteristics and “diagnoses” on service utilization and retention in the programs. In both models, predictors are entered in a planned sequence of sets to examine the incremental effects of indicators at each successive step in the regression analysis. Both models begin with examining the effects of project site, overall time involved with the program, and demographic characteristics and their interactions on the dependent measure. However, the two models diverge in the way that the multiple diagnosis construct is operationalized as follows.

Multiple diagnosis model. In the first model tested, referred to as the “Multiple Diagnosis Model,” indicators of HIV Status (positive versus unknown), Mental Health System Involvement (present versus unknown), and Substance Abuse (present versus unknown) are explicitly coded. Each of these three indicators is entered into the regression model after testing for the effects of site and program duration, demographics, and interactions among demographic characteristics on service utilization (or in the case of Cox regression, program retention). After examining the main effects of HIV Status, Mental Health System Involvement, and Substance Abuse, two-way

interactions among those three indicators are entered to represent combinations of those issues as “dual diagnoses” – that is, having both a positive HIV Status and Mental Health System Involvement, positive HIV Status and Substance Abuse, or Mental Health System Involvement and Substance Abuse. At the next step, a three-way interaction term representing “triple diagnosis” is entered – that is, having a positive HIV Status, Mental Health System Involvement, and Substance Abuse. Finally, the effects of being homeless, runaway, or involved with the criminal justice system are examined after controlling for the indicators entered at earlier steps in the analysis. The Multiple Diagnosis Model assumes that service utilization and retention patterns are predicted not only by the number of problems indicated, but by the specific combinations of HIV Status, Mental Health System Involvement, and Substance Abuse indicated for the clients.

Burden model. The alternate model tested, referred to as the “Burden Model,” defines the multiple diagnosis issue somewhat differently. In this model, the number of “diagnoses” indicated by the data (i.e., positive HIV Status, Mental Health System Involvement, and Substance Abuse) are summed to form a single index of therapeutic burden, ranging from 0 to 3. The burden term is entered as a single step in the analysis. Thus, as compared to the Multiple Diagnosis Model, which assumes that specific combinations of diagnostic indicators are meaningful, the Burden Model assumes that it is the overall number of therapeutic issues presented by the youth that predicts service utilization and retention patterns. After examining the effect of the number of problems indicated (or “burden”), the final step in the Burden Model – as in the Multiple Diagnosis Model – is to examine the effects of being homeless, runaway, or involved with the criminal justice system after controlling for the indicators entered at earlier steps.

To summarize the sequence of model tests made here for both the multiple linear regression and the Cox regression analyses, Table I shows the order in which sets of variables are entered. At each step, statistical tests are made to determine if the entry of those variables into the overall prediction equation sufficiently increment the predictive power of the model. At each step we determine the squared multiple correlation of the predictor and dependent variables and the incremental test for the regression. After determining which sets of predictors significantly increment the regressions, we then look at whether individual predictors in each set have statistically independent predictive power for each dependent variable.

 Insert Table I About Here

In both the linear and Cox regression analyses, standardized regression coefficients are interpreted at each step. When a standardized regression coefficient is presented, the model from which it is derived is that where all effects “above” it in the table have been included, but all effects lower in the hierarchy of entry, (or “below” it in the table), have not been included. For example, the effects given for the demographic variables at Step 2 control for all prior effects at Step 1 (that is, the site and length of service episode) but do not control for the effects that will later be entered into the model at Steps 3 through 7. Similarly, the effects at Step 3 control for effects at Steps 1 and 2 but not those at later steps. Note that for all analyses we do not present individual regression coefficients for specific sites because in this cross-cutting evaluation individual sites are not explicitly compared.

Participants

The data used for these analyses were collected between December 1993 and March 1998. The program clients for these regression analyses were 1,710 young men and 2,022 young

women who were enrolled in service programs of the 10 projects and for whom information about HIV risk behaviors was coded. Of the 1,710 young men, 329 were known to be HIV-positive. Of the 2,022 young women, 129 were known to be HIV-positive. The men were an average of 20.1 years of age ($SD = 3.7$ years) and the women were an average of 18.8 years of age ($SD = 3.1$ years) ($t(3715) = 11.65, p < .001$). In terms of ethnicity, 19.5 percent of the men were African American, 3.7 percent were Asian American, 47.4 percent were Caucasian, 19.2 percent were Hispanic/Latino, 1.6 percent were Native American, 4.7 percent were multi-racial and 3.8 percent had an other or unknown ethnicity. Among the women, 24.6 percent were African American, 2.9 percent were Asian American, 44.9 percent were Caucasian, 18.5 percent were Hispanic/Latina, 1.4 percent were Native American, 5.0 percent were multiracial, and 3.3 percent had an other or unknown ethnicity. The young men received a mean of 6.7 intervention services ($SD = 16.0$) and the young women received a mean of 4.3 intervention services ($SD = 10.7$). The analyses are based on a sample of 3,732 complete cases.

Measures

Multiple diagnoses. The combination of information known about a young person's HIV status, mental health service system involvement, and substance abuse was coded and combined in various ways to examine issues of multiple diagnoses. HIV status was coded dichotomously as being positive or unknown. Mental health issues were coded dichotomously as to whether or not the youth was known to have involvement with the mental health service delivery system. Note that this measure is a proxy for more detailed information about a true mental health diagnosis. Substance abuse issues were coded dichotomously as to whether the young person was known to abuse substances either within the last 30 days or prior to the last 30 days. Half of the participants were identified as having at least one "diagnosis" based on these criteria. A total of 49.9 percent

of the youth had no problem identified, 38.4 percent had one problem identified, 10.2 percent had two diagnostic issues identified, and 1.6 percent had all three indicated.

Examining those youth with one problem coded, 193 youth (5.2 percent of the entire sample) were identified as HIV-positive (with no mental health or substance abuse issues), 290 youth (7.8 percent of the entire sample) were identified as mental health-involved (with no known substance abuse issues and of unknown HIV status), and 950 were identified as substance abusers (with no known mental health issues and of unknown HIV status). Examining the youth coded with dual problems, 32 youth (0.9 percent of the entire sample) were identified as HIV-positive with mental health issues, 175 (4.7 percent of the entire sample) were identified as HIV-positive with substance abuse issues, and 173 (4.6 percent of the entire sample) were identified as having both mental health and substance abuse issues.

Level of burden. One ‘point’ was given to an overall index of burden for the client for each of a number of conditions indicated in the data. A point was given for HIV status if the client was verified to be positive by an HIV antibody test conducted at the program or received from another medical provider. 12.3 percent of the youth in the study were identified as HIV-positive. To represent psychological problems or diagnoses, one point is given if the youth was identified as having been involved in the mental health service system. The percentage of youth who got a positive score on this indicator was 14.8 percent. A point was assigned for substance abuse if the client was identified as a current (within the last 30 days) or former (prior to the last 30 days) substance abuser. 36.3 percent of the youth in the study got a positive score on this indicator.

It should be noted that here in the context of the analyses presented here, overall burden is coded as a simple sum of the factors listed above. Each receives the same weight in the sum, so there are many different ways that an individual client could get a particular score, such as “2.”

The average burden score was 0.6 with a standard deviation of 0.7. The distribution was as follows: 49.9 percent had a score of 0; 38.4 percent had a score of 1; 10.2 percent had a score of 2; and 1.6 percent had a score of 3. The three burden elements were intercorrelated $r = .05$ to $r = .11$ (all significant at $p < .01$).

Specific service utilization. In addition to overall retention in the program, we also studied the patterns of utilization of various services by the youth. From our earlier analyses (Huba, Melchior, Panter, Feudo, Schneir, Trevithick, Wright, Martinez, Woods, Sturdevant, Remafedi, Greenberg, Tierney, Wallace, Goodman, Tenner, Marconi, Brady, and Singer, under review; Huba, Wright, Melchior, Woods, Panter, Remafedi, Trevithick, Schneir, Goodman, Greenberg, Bettencourt, Sturdevant, Feudo, Tierney, Wallace, Brady, Singer, and Marconi, under review), four major kinds of services and three major kinds of referrals have been identified in these 10 projects. Those types of services are: a) HIV Testing Services including HIV risk assessment, HIV pre-test counseling, HIV testing, HIV post-test counseling, HIV prevention, and other prevention services; b) Psychosocial Counseling and Peer Support Services including individual counseling, group counseling, alternative therapy, information and referral, practical support, HIV support groups, peer support groups, 12-step groups, and recreation; and c) Medical Services including medical examinations, medical lab work (not HIV-related), medical appointments, medical emergency services, and medical walk-in services; and d) Case Management Services. The referral categories are: a) Psychosocial Service Referrals including receiving referrals to educational or vocational training, mental health services, substance abuse services, self-help groups, food or drop-in centers, shelter or housing programs, and social services; b) Medical Service Referrals including referrals to a STD clinic, HIV testing, medical services, or family planning; and c) Collateral Service Referrals consisting of referrals to case management (a single item).

Program retention. For the purpose of the analyses here, the index of program retention is the total number of days between the time that the client enrolls in the program (or first receives services) and the day that he or she has last received services.

RESULTS

How Is Level of Burden Related to Service Utilization?

Tables 2 through 8 summarize the results of two sets of linear regression analyses to determine the effects of client characteristics – including level of burden – on utilization of four types of direct services and three types of service referrals from the adolescent care projects. Results from two alternate models are shown in each table as the Multiple Diagnosis Model (a) and the Burden Model (b).

Utilization of HIV testing services. Table II shows the regression coefficients for the prediction of utilization of HIV Testing Services by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving HIV Testing Services. Beyond these effects, client background characteristics significantly increment the prediction of HIV Testing Services utilization, as do the two-way interactions of client characteristics. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of HIV Testing Services. Note that HIV-positive youth do not tend to use these services, as they are more likely to have been already tested before enrolling in these projects. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of HIV Testing Services, as does the three-way interaction of diagnostic indicators added at the subsequent step. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement significantly increments the prediction of HIV Testing Services.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) does not incrementally predict the number of HIV Testing Service sessions received by the participants. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement significantly predicts utilization of HIV Testing Services.

Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table II About Here

Utilization of psychosocial counseling and peer support services. Table III shows the regression coefficients for the prediction of utilization of Psychosocial Counseling and Peer Support Services by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving Psychosocial Counseling and Peer Support Services. Beyond these effects, client background characteristics significantly increment the prediction of psychosocial service utilization, as do the two-way interactions of client characteristics. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Psychosocial Counseling and Peer Support Services. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of services in this category; however, the three-way interaction of diagnostic indicators added at the subsequent step does not additionally increment the prediction of psychosocial services. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement do not significantly increment the prediction of Psychosocial Counseling and Peer Support Services.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) significantly predicts the number of Psychosocial Counseling and Peer Support sessions received by the participants. That is, after controlling for the effects of site, service intensity, and demographic characteristics, the level of burden has a significant effect on the number of psychosocial service sessions utilized by the participants. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement does not additionally predict utilization of Psychosocial Counseling and Peer Support Services. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table III About Here

Utilization of medical services. Table IV shows the regression coefficients for the prediction of utilization of Medical Services by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving Medical Services. Beyond these effects, client background characteristics significantly increment the prediction of Medical Services utilization, as do the two-way interactions of client characteristics. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Medical Services. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators do not predict utilization of Medical Services, nor do the three-way interaction of diagnostic indicators added at the subsequent step. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement significantly increment the prediction of Medical Services.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) significantly predicts the number of Medical Service sessions received by the participants. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement also significantly predicts utilization of Medical Services. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table IV About Here

Utilization of case management services. Table V shows the regression coefficients for the prediction of utilization of Case Management Services by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving case management. Beyond these effects, client background characteristics do not increment the prediction of case management utilization. However, the two-way interactions of client characteristics do have an effect on the number of case management sessions used by participants. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Case Management Services. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of case management sessions, although the three-way interaction of diagnostic indicators added at the subsequent step does not. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement does not additionally increment the prediction of case management utilization.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) has a significant effect on the number of case management sessions received by the participants in that youth with higher burden scores received more case management. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement does not have an effect on the utilization of case management services. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table V About Here

Utilization of psychosocial service referrals. Table VI shows the regression coefficients for the prediction of utilization of Psychosocial Referrals by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving Psychosocial Referrals. Beyond these effects, client background characteristics significantly increment the prediction of the number of Psychosocial Service Referrals received, although the two-way interactions of client characteristics do not additionally add to the prediction of who receives these services. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Psychosocial Service Referrals. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of Psychosocial Service Referrals, although the three-way interaction of diagnostic indicators added at the subsequent step does not. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement significantly increments the prediction of Psychosocial Service Referral utilization.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) has a statistically significant effect on the utilization of Psychosocial Service Referrals by the participants. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement also significantly predicts utilization of Psychosocial Service Referrals. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table VI About Here

Utilization of medical service referrals. Table VII shows the regression coefficients for the prediction of utilization of Medical Referrals by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving Medical Service Referrals. Beyond these effects, client background characteristics significantly increment the prediction of Medical Service Referral utilization, as do the two-way interactions of client characteristics. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Medical Service Referrals. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of Medical Service Referrals, although the three-way interaction of diagnostic indicators added at the subsequent step does not. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement significantly increments the prediction of Medical Service Referrals.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) has a statistically

significant effect on the utilization of Medical Service Referrals. After considering the level of burden, the addition of homelessness, being a runaway, and criminal justice system involvement also predicts utilization of Medical Service Referrals. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table VII About Here

Utilization of collateral service referrals. Table VIII shows the regression coefficients for the prediction of utilization of Collateral Service Referrals by program participants. For the Multiple Diagnosis Model, the effects of project site, the number of service dates, and the total time in program are significantly associated with receiving referrals to case management. Beyond these effects, client background characteristics do not significantly predict the number of case management referrals received by participants. However, the two-way interactions of client characteristics do have an effect on Collateral Service Referral utilization. After controlling for these effects, the diagnostic indicators of HIV status, mental health system involvement, and substance abuse significantly predict utilization of Collateral Service Referrals. Beyond the effects of the single diagnostic indicators, the dual diagnosis indicators also predict utilization of Collateral Service Referrals, although the three-way interaction of diagnostic indicators added at the subsequent step does not. Finally, the addition of indicators of homelessness, runaway, and criminal justice system involvement significantly adds to the prediction of the number of referrals to case management.

For the Burden Model, the first three steps are identical to those used in the Multiple Diagnosis Model. At the fourth step, the number of diagnoses (or burden level) has a significant effect on utilization of Collateral Service Referrals. After considering the level of burden, the

addition of homelessness, being a runaway, and criminal justice system involvement also significantly predicts utilization of Collateral Service Referrals. Of the two formulations, the Multiple Diagnosis Model is the better one for these data.

 Insert Table VIII About Here

How do multiple diagnoses affect retention in care? Figures 1 and 2 show two sets of retention curves based on Kaplan-Meier survival analyses of program participants based on their diagnostic classification. Figure 1 shows eight separate retention curves based on the specific combinations of HIV status, mental health system involvement, and substance abuse to represent single, dual, and triple diagnoses. The eight groups include: youth with no known diagnoses ($n = 1,861$); those known to have only problems of being HIV-positive ($n = 193$), mental health services-involved ($n = 290$), or substance abuse ($n = 950$); those with dual problems of HIV and mental health ($n = 32$), HIV and substance abuse ($n = 175$), or mental health and substance abuse ($n = 173$); and those with all three problems (triple diagnosed; $n = 58$). These groups correspond to the Multiple Diagnoses Model.

An alternate strategy for examining retention patterns based on the Burden Model is shown in Figure 2. The four groups shown in Figure 2 represent those with no known problem ($n = 1,861$), and one ($n = 1,433$), two ($n = 380$), and three ($n = 58$) identified diagnostic issues.

In the context of survival analysis or Cox regression, a “censored” case is one in which the client was enrolled in the program at the time that data collection was stopped. Hence, he or she would usually have a larger retention “score” if data had been collected for additional days. The analysis methods used here specifically account for this “censored” data and minimize any bias that might be introduced. Nonetheless, it is the convention in such analyses to plot the cases

and label them as “censored” so that their effect may be seen. Cases were censored in these analysis if the last service date was more than 120 days before the end of data collection.

Examining the retention curves in Figure 1 (based on the Multiple Diagnosis Model), there is a clear effect for youth with multiple diagnoses, as well as those who are known to be HIV-positive, to remain in the programs longer. The mean retention for youth with no known diagnosis is 76.38 days (standard error ± 4.22). The median retention for this group is 8 days (standard error cannot be estimated). HIV-positive youth with no additional diagnoses are retained an average of 416.41 days (standard error ± 28.49). The median retention for this group is 356 days (standard error ± 34.49). Mental health system-involved youth with no additional diagnoses are retained an average of 126.30 days (standard error ± 14.43), with a median retention of 15 days (standard error ± 1.36). Substance abusers with no additional diagnoses are retained an average of 120.33 days (standard error ± 8.26), with a median retention of 8 days (standard error ± 0.51). Among the youth coded as dually-diagnosed, the HIV-positive mental health system-involved youth, have a mean retention of 485.04 days (standard error ± 82.57), with a median retention of 344 days (standard error ± 118.79). The HIV-positive substance abusers have a mean retention of 417.41 days (standard error ± 35.07) with a median retention of 290 days (standard error ± 83.08). The substance abusers with mental health system-involvement stay an average of 196.63 days (standard error ± 23.70), with a median stay of 15 days (standard error ± 4.70). Finally, the triply-diagnosed youth are retained an average of 624.67 days (standard error ± 71.38), with a median stay of 456 days (standard error ± 124.57). The retention patterns are significantly different from one another; the chi-squared values under the log-rank, Breslow, and Tarone-Ware assumptions are 469.18, 372.60, and 447.18, respectively, each with 7 degrees of freedom and significant at $p < .001$.

 Insert Figure 1 About Here

Turning to the alternate Burden Model represented by the retention curves in Figure 2, there is also a clear effect for youth with multiple diagnoses to remain in the programs longer. The mean retention for youth with no known diagnosis is 76.38 days (standard error ± 4.22). The median retention for this group is 8 days. Youth with a burden score of 1 (or those with a single diagnosis) are retained an average of 162.95 days (standard error ± 7.84). The median retention for this group is 15 days. Those with a burden score of 2 (or those with a dual diagnosis) are retained an average of 322.68 days (standard error ± 21.41), with a median retention of 111 days. Those with a burden score of 3 (or those with a triple diagnosis) are retained an average of 624.67 days (standard error ± 71.38), with a median retention of 456 days. The retention patterns based on this model are significantly different from one another; the chi-squared values under the log-rank, Breslow, and Tarone-Ware assumptions are 330.83, 219.04, and 281.99, respectively, each with 3 degrees of freedom and significant at $p < .001$.

 Insert Figure 2 About Here

Shifting from the simpler Kaplan-Meier survival analysis to the more sophisticated Cox regression model, Table IX shows which of the factors in our conceptual data analysis model impact upon the retention rates in the program. The models fit for the two parts of Table IX (A and B) reflect the Multiple Diagnosis Model and the Burden Model, respectively. As can be seen in comparing the two models, in both cases retention is greatest for women, younger clients, and youth with more service dates. For the Multiple Diagnosis Model, the single indicators of HIV,

mental health, and substance abuse all significantly predict retention. Youth who are known to be living with HIV, mental health services-involved, and substance abusers are retained longer. The steps at which the two-way interactions among those variables are added, however, do not significantly increment the prediction of retention. After examining the effects of the diagnostic indicators, homelessness also significantly predicts retention.

With respect to the Burden model (summarized in Part B of Table IX), the first three steps are identical to those in the Multiple Diagnosis Model (summarized in Part A). After controlling for the effects of site, service dates, and background characteristics, youth with higher burden levels are retained longer in the programs. As in the Multiple Diagnosis Model, homeless youth are also retained longer after controlling for the effects of burden level. Of the two formulations, the Burden Model is the better one for these data.

 Insert Table IX About Here

DISCUSSION

The concept of multiple clinical conditions among clients, with the impact of such problems on the service system is a topic that is currently one underlying the planning of many service systems. Many systems are currently being redesigned to meet the special needs of those individuals with co-occurring issues related to HIV, substance abuse, and mental health. This paper has shown that such issues among youth do have significant implications for the service system. Specifically, the presence of various diagnostic conditions does lead to the increased use of services. Youth identified with multiple therapeutic issues in these 10 programs tend to use more services and to be retained in the programs longer.

The contrast of two competing models of services – the Multiple Diagnosis and Burden Models – is complex in these data. There is no strong and clear superiority of one model over the other in predicting how many services will be used or the overall retention of clients in the programs. The analyses suggest that in predicting who will use the highest levels of certain services, it is important to know various combinations of single, double, and triple clinical problems. In other cases, it may be sufficient to know how many of these problems the youth has (either the simple burden score or just the main effects for the three problem areas). In terms of program retention, it may be more important to know how many problems the youth has (among these three) in predicting how long the youth will be linked with the program than it is to know the specific pattern of single, double, or triple diagnosis. Overall, the data from these 10 projects do not clearly favor one of these models over the other. The differentiation of the two models may have fairly important implications for the design of service systems and the allocation of resources to different kinds of programs. Hence, it may be valuable in the future to design evaluations that specifically examine the advantages and cost-effectiveness of each of these two conceptual models for addressing co-occurring problems.

Several caveats should be noted in discussing the findings presented here. First, truly diagnostic information about the participants' substance abuse and mental health problems was not available in the present investigation. The indicators used in these analyses are not DSM-IV diagnoses, but rather proxies of such. While the true rates of substance abuse and other mental disorders in this sample may differ from those identified using the proxy measures, the measurement heuristic employed here is useful for a number of reasons. Community-based programs such as these adolescent HIV care models are often staffed by people with various backgrounds and training, including paraprofessional counselors – often peers or former clients of the program themselves. Access to trained mental health clinicians can be limited. More

importantly, even if the client does interface with a clinician who can make a true mental health diagnosis, it is usually other front-line staff who make initial assessments of the client's presenting problems and needs and who triage the youth into appropriate services within the continuum of care. Thus, knowing that a young person is somehow involved in mental health services does seem to indicate that the youth is routed to a different set of services in these 10 projects than if he or she were not identified as such. Recent work by Brown, Melchior, and Huba (in press) suggests that among women in substance abuse treatment, having a concomitant diagnosis of severe mental illness predicts increased retention in the program; it is expected that similar findings would be obtained in this sample of youth if DSM-IV diagnoses were available.

It is likely that the actual level of service provision in these 10 projects is underestimated in the present study. The data included in the present analyses only reflects outpatient services defined in common across the 10 projects. One of the projects provides a residential treatment program specifically targeted to multiply-diagnosed youth, and the interventions provided in the context of residential treatment are not included in the data analyzed here. Thus, although the present findings clearly suggest that a higher level of intensity is needed to provide care to youth with multiple therapeutic issues, the actual level of effort needed to serve such youth may be even more intensive than that demonstrated in the present study.

The findings presented here should be interpreted within the context that the participants in these programs were not selected to be a representative sample of all youth. The 10 projects were funded to provide innovative models of HIV-related care to very specific groups of young people, namely those living with HIV or at-risk to become so. Thus the participants are not intended to be a random sample of all youth, or even all HIV-positive and at-risk youth, but rather a group specifically targeted by these model programs to potentially benefit from engaging in these innovative service models. The rates of multiple therapeutic issues are not expected to be

representative of a general population, but again, reflect the nature of the youth targeted for intervention by these 10 service model demonstration projects.

Overall, the pattern of results in these analyses suggest that youth with multiple problems will need higher levels of services and will need to be retained longer in programs. Such clients are costly in programs in terms of the resources that they use, and it is very important to design services so that the multiple needs of such individuals can be addressed.

A pattern that clearly emerges from the present study is that youth with multiple therapeutic issues require a significantly higher level of intervention than youth without co-occurring conditions. Effectively serving young people with multiple problems is highly resource intensive. Although, from a monetary perspective, it is likely to cost more to provide needed services to such youth, it is ultimately cost-effective in that retaining a multiply-diagnosed youth in care, leads to savings in other systems (e.g., criminal justice, emergency medical costs).

At the same time, it should be noted that multiply-diagnosed youth are notoriously difficult to engage and retain in care. The fact that these 10 projects have been able to do so, and have demonstrated that such youth can be appropriately linked and retained in needed health, psychosocial, and ancillary support services, speaks to the success of these 10 models of adolescent HIV care. Given that one of the purposes of the initiative under which these programs were funded is to disseminate innovative and effective models of care for youth living with HIV or at high risk for HIV infection, it is hoped that others wishing to service this high need population can replicate the success of these programs to meet the needs of such youth.

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Table I. Summary of the Entry Order for Predictor Variables in the Logistic and Multiple Linear Regression Models
(Variables Entered in Sets): Two Alternate Models

Multiple Diagnosis Model				Burden Model			
Step	Description	Indicators	Number of Terms	Step	Description	Indicators	Number of Terms
1	Site effect and intensity of services	9 dummy-coded indicators of the 10 sites; total days in program; number of service episodes (this indicator is used only in the analysis of Table III)	11	1	Site Effect and Intensity of Services	9 dummy-coded indicators of the 10 sites; total days in program; number of service episodes (this indicator is used only in the analysis of Table III)	11
2	Client demographics	Gender; age; ethnicity	3	2	Client Demographics	Gender; age; ethnicity	3
3	Client demographics and program intensity interactions	2-way interactions of gender-age; number of service days-gender	2	3	Client Demographics and Program Intensity Interactions	2-way interactions of gender-age; number of service days-gender	2
4	Diagnostic variables	HIV status (Positive versus unknown); substance abuse (yes/no); mental health system involvement (yes/no)	3	4	Burden	Number of problems/diagnoses coded (ranges from 0 to 3)	1
5	Dual diagnosis	2-way interactions of HIV status – substance abuse; HIV status-mental health system involvement; substance abuse-mental health system involvement	3				
6	Triple diagnosis	3-way interaction of HIV status-substance abuse-mental health system involvement	1				
7	Other defining characteristics	Homeless, runaway, criminal justice system involvement	3	5	Other Defining Characteristics	Homeless, runaway, criminal justice system involvement	3

Table II. Hierarchical Multiple Regression on HIV Testing Services

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on HIV Testing Services (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.29	.29	F(11,3720)=135.57***	---	---	---
Site						
Number of service dates				.00	.16	8.69***
Number of days in program				.08	.23	12.74***
Step 2: Background characteristic	.29	<.01	F(8,3712)=4.25***			
Gender				-.07	-.01	-.54
Age				-.09	-.07	-4.47***
African American				-.17	-.02	-.47
Asian American				.14	.01	.30
Caucasian				-.09	-.01	-.25
Hispanic				.32	.03	.89
Native American				.88	.02	1.46
Multi-racial				-.54	-.03	-1.25
Step 3: Two-way interactions with background characteristics	.30	.01	F(2,3710)=21.24***			
Gender by age				.11	.04	2.72**
Gender by service dates				-.06	-.09	-6.03***
Step 4: Diagnosis variables	.34	.04	F(3,3707)=63.29***			
HIV				-3.81	-.28	-13.28***
Mental health				.54	.04	3.12**
Substance abuse				.34	.04	2.33*
Step 5: Dual diagnosis	.31	<.01	F(3,3704)=13.15***			
HIV by mental health				-2.52	-.07	-5.20***
HIV by substance abuse				-.62	-.02	-1.02
Mental health by substance abuse				1.32	.05	3.78***
Step 6: Triple diagnosis	.35	<.01	F(1,3703)=17.04***			
HIV by mental health by substance abuse				-4.03	-.06	-4.13***
Step 7: Other client characteristics	.35	<.01	F(3,3700)=9.43***			
Homeless				.04	.00	.21
Runaway				.83	.05	3.21**
Criminal justice system-involved				.92	.06	3.70***
B. Hierarchical Multiple Regression on HIV Testing Services (Burden Model)						
Step 1: Site and service episodes	.29	.29	F(11,3720)=135.57***	---	---	---
Site						
Number of service dates				.00	.16	8.69***
Number of days in program				.08	.23	12.74***
Step 2: Background characteristic	.29	<.01	F(8,3712)=4.25***			
Gender				-.07	-.01	-.54
Age				-.09	-.07	-4.47***
African American				-.07	-.02	-.47
Asian American				.14	.01	.30
Caucasian				-.09	-.01	-.25
Hispanic				.32	.03	.89
Native American				.88	.02	1.46
Multi-racial				-.54	-.03	-1.25
Step 3: Two-way interactions with background characteristics	.30	.01	F(2,3710)=21.24***			
Gender by age				.11	.04	2.72**
Gender by service dates				-.06	-.09	-6.03***
Step 4: Number of diagnoses	.30	<.01	F(1,3709)=2.98			
Number of diagnoses				-.17	-.03	-1.73
Step 5: Other client characteristics	.31	.01	F(3,3706)=15.62***			
Homeless				-.01	.00	-.06
Runaway				1.06	.06	4.02***
Criminal justice system-involved				1.24	.08	4.90***

*p < .05, **p < .01, ***p < .001

Table III. Hierarchical Multiple Regression on Psychosocial Counseling and Peer Support Services

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Psychosocial Counseling and Peer Support Services (Multiple Diagnosis Model)						
Step 1: Site and Service Episodes	.95	.95	F(11,3720)=6128.33***	---	---	---
Site				.00	-.04	-7.15***
Number of service dates				2.03	1.00	204.35***
Number of days in program						
Step 2: Background characteristics	.95	<.01	F(8,3712)=3.47***			
Gender				-.12	.00	-.53
Age				.00	.00	-.04
African American				.28	.00	.46
Asian American				-1.47	-.01	-1.86
Caucasian				-.37	-.01	-1.65
Hispanic				.91	.01	1.49
Native American				.49	.00	.49
Multi-racial				.89	.01	1.23
Step 3: Two-way interactions with background characteristics	.95	<.01	F(2,3710)=11.42***			
Gender by age				-.06	.00	-.86**
Gender by service dates				-.08	-.02	-4.66***
Step 4: Diagnosis variables	.95	<.01	F(3,3707)=42.61***			
HIV				4.76	.06	9.93***
Mental health				4.28	.01	3.22**
Substance abuse				1.40	.01	3.29*
Step 5: Dual diagnosis	.95	<.01	F(3,3704)=34.25***			
HIV by mental health				4.76	.02	5.90***
HIV by substance abuse				4.28	.03	6.67***
Mental health by substance abuse				1.40	.01	2.39*
Step 6: Triple diagnosis	.95	<.01	F(1,3703)=2.30			
HIV by mental health by substance abuse				2.47	.01	1.52
Step 7: Other client characteristics	.95	<.01	F(3,3700)=1.19			
Homeless				.48	.01	1.51
Runaway				-.42	.00	-.97
Criminal justice system-involved				.41	.00	.98
B. Hierarchical Multiple Regression on Client Characteristics for Psychosocial/Peer Support Services (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.95	.95	F(11,3720)=6128.33***	---	---	---
Site				2.03	1.00	204.35***
Number of service dates				.00	-.04	-7.15***
Number of days in program						
Step 2: Background characteristic	.95	<.01	F(8,3712)=3.48**			
Gender				-.12	.00	-.53
Age				.00	.00	-.04
African American				.28	.00	.46
Asian American				-1.47	-.01	-1.86
Caucasian				-.37	-.01	-.65
Hispanic				.91	.01	1.49
Native American				.49	.00	.49
Multi-racial				.89	.01	1.23
Step 3: Two-way interactions with background characteristics	.95	<.01	F(2,3710)=11.42***			
Gender by age				-.06	.00	-.86
Gender by service dates				-.08	-.02	-4.66***
Step 4: Number of diagnoses	.95	<.01	F(1,3709)=71.27***			
Number of diagnoses				1.41	.04	8.44***
Step 5: Other client characteristics	.95	<.01	F(3,3706)=1.14			
Homeless				.45	.01	1.41
Runaway				-.63	-.01	-1.45
Criminal justice system-involved				.03	.00	.08

*p < .05, **p < .01, ***p < .001

Table IV. Hierarchical Multiple Regression on Medical Services

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Medical Services (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.32	.32	F(11,3720)=156.92***			
Site				---	---	---
Number of service dates				.01		16.22***
Number of days in program				.14		17.30***
Step 2: Background characteristics	.33	.01	F(8,3712)=6.44***			
Gender				.58	.05	3.18**
Age				-.15	-.08	-5.00***
African American				.66	.04	1.32
Asian American				.63	.02	.96
Caucasian				.10	.01	.21
Hispanic				.30	.02	.58
Native American				.53	.01	.64
Multi-racial				-.29	-.01	-.48
Step 3: Two-way interactions with background characteristics	.37	.04	F(2,3710)=124.44***			
Gender by age				-.16	-.04	-3.05**
Gender by service dates				.20	.22	15.59***
Step 4: Diagnosis variables	.41	.04	F(3,3707)=91.25***			
HIV				5.47	.28	14.46***
Mental health				.18	.01	.79
Substance abuse				1.34	.10	6.92***
Step 5: Dual diagnosis	.41	<.01	F(3,3704)=2.45			
HIV by mental health				.74	.02	1.15
HIV by substance abuse				-.22	-.01	-.42
Mental health by substance abuse				1.03	.03	2.20*
Step 6: Triple diagnosis	.41	<.01	F(1,3703)=2.73			
HIV by mental health by substance abuse				2.15	.02	1.65
Step 7: Other client characteristics	.42	.01	F(3,3700)=22.46***			
Homeless				.30	.02	1.18
Runaway				1.24	.05	3.58***
Criminal justice system involved				2.17	.09	6.57***
B. Hierarchical Multiple Regression on Client Characteristics for Medical Services (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.32	.32	F(11,3720)=156.92***			
Site				---	---	---
Number of service dates				.14	.31	17.30***
Number of days in program				.01	.29	16.22***
Step 2: Background characteristic	.33	.01	F(8,3712)=6.44***			
Gender				.58	.05	3.18**
Age				-.15	-.08	-5.00***
African American				.66	.04	1.32
Asian American				.63	.02	.96
Caucasian				.10	.01	.21
Hispanic				.30	.02	.58
Native American				.53	.01	.64
Multi-racial				-.29	-.01	-.48
Step 3: Two-way interactions with background characteristics	.37	.04	F(2,3710)=124.44***			
Gender by age				-.16	-.04	-3.05**
Gender by service dates				.20	.22	15.59***
Step 4: Number of diagnoses	.39	.02	F(1,3709)=127.92***			
Number of diagnoses				1.51	.17	11.31***
Step 5: Other client characteristics	.40	.01	F(3,3706)=14.30***			
Homeless				.41	.02	1.63
Runaway				.69	.03	2.00
Criminal justice system-involved				1.85	.08	5.52***

*p < .05, **p < .01, ***p < .001

Table V. Hierarchical Multiple Regression on Case Management Services

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Case Management Services (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.81	.81	F(11,3720)=1472.53***			
Site				---	---	---
Number of service dates				.00	-.08	-8.80***
Number of days in program				.77	.94	102.10***
Step 2: Background characteristics	.81	<.01	F(8,3712)=1.66			
Gender				-.23	-.018	-1.38
Age				-.02	-.01	-.77
African American				.25	.01	.55
Asian American				-.43	-.01	-.71
Caucasian				-.38	-.02	-.86
Hispanic				-.11	.00	-.24
Native American				-.57	-.01	-.74
Multi-racial				-.85	-.02	-1.53
Step 3: Two-way interactions with background characteristics	.82	.01	F(2,3710)=29.27***			
Gender by age				-.03	.00	-.65
Gender by service dates				-.09	-.06	-7.59***
Step 4: Diagnosis variables	.82	<.01	F(3,3707)=30.60***			
HIV				3.42	.10	9.35***
Mental health				.29	.01	1.31
Substance abuse				.14	.01	.74
Step 5: Dual diagnosis	.82	<.01	F(3,3704)=17.38***			
HIV by mental health				.91	.01	1.47
HIV by substance abuse				3.11	.05	6.30***
Mental health by substance abuse				.99	.02	2.21*
Step 6: Triple Diagnosis	.82	<.01	F(1,3703)=.09			
HIV by mental health by substance abuse				-.38	.00	-.30
Step 7: Other client characteristics	.82	<.01	F(3,3700)=1.46			
Homeless				-.02	.00	-.10
Runaway				.16	.00	.49
Criminal justice system-involved				.63	.02	1.97*
B. Hierarchical Multiple Regression on Client Characteristics for Case Management Services (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.81	.81	F(11,3720)=1472.53***			
Site				---	---	---
Number of service dates				.00	.08	-8.80***
Number of days in program				.77	.94	102.10***
Step 2: Background characteristic	.81	<.01	F(8,3712)=1.66			
Gender				.23	-.01	-1.38
Age				-.02	-.01	-.77
African American				.25	.01	.55
Asian American				-.43	-.01	-.71
Caucasian				-.38	-.02	-.86
Hispanic				-.11	.00	-.24
Native American				-.57	-.01	-.74
Multi-racial				-.85	-.02	-1.53
Step 3: Two-way interactions with background characteristics	.82	<.01	F(2,3710)=29.27***			
Gender by age				-.03	.00	-.65
Gender by service dates				-.03	-.06	-7.59***
Step 4: Number of diagnoses	.82	<.01	F(1,3709)=26.38***			
Number of diagnoses				.66	.04	5.14***
Step 5: Other client characteristics	.82	<.01	F(3,3706)=.39			
Homeless				-.05	.00	-.19
Runaway				.01	.00	.03
Criminal justice system-involved				.34	.01	1.06

*p < .05, **p < .01, ***p < .001

Table VI. Hierarchical Multiple Regression on Psychosocial Service Referrals

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Psychosocial Service Referrals (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.62	.62	F(11,3720)=540.26***			
Site				---	---	---
Number of service dates				.00	.05	3.62***
Number of days in program				.51	.74	55.83***
Step 2: Background characteristics	.62	<.01	F(8,3712)=.42			
Gender				-.70	-.04	-3.43**
Age				-.07	-.03	-2.26*
African American				.06	.00	.11
Asian American				-.74	-.01	-1.01
Caucasian				.15	.01	.28
Hispanic				.51	.02	.90
Native American				-.06	.00	-.07
Multi-racial				.24	.01	.35
Step 3: Two-way interactions with background characteristics	.62	<.01	F(2,3710)=26.22***			
Gender by age				.05	.01	.85
Gender by service dates				.00	.00	.31
Step 4: Diagnosis variables	.63	.01	F(3,3707)=45.92***			
HIV				2.31	.08	5.14***
Mental health				.54	.02	2.00*
Substance abuse				1.47	.08	6.41***
Step 5: Dual diagnosis	.64	.01	F(3,3704)=2.06			
HIV by mental health				4.98	.07	6.61***
HIV by substance abuse				5.10	.09	8.53***
Mental health by substance abuse				.73	.01	1.33
Step 6: Triple diagnosis	.64	<.01	F(1,3703)=19.86***			
HIV by mental health by substance abuse	.65	.01		2.18	.02	1.44
Step 7: Other client characteristics			F(3,3700)=22.46***			
Homeless				.44	.02	1.52
Runaway				.28	.01	.69
Criminal justice system-involved				2.81	.08	7.30***
B. Hierarchical Multiple Regression on Client Characteristics for Psychosocial Service Referrals (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.62	.62	F(11,3720)=540.26***			
Site				---	---	---
Number of service dates				.51	.74	55.83***
Number of days in program				.00	.05	3.62***
Step 2: Background characteristic	.62	<.01	F(8,3712)=2.62*			
Gender				-.70	-.04	-3.42**
Age				-.07	-.03	-2.26*
African American				.06	.00	.11
Asian American				-.74	.01	-1.01
Caucasian				.15	.01	.28
Hispanic				.51	.02	.90
Native American				-.06	.00	-.07
Multi-racial				.24	.01	.35
Step 3: Two-way interactions with background characteristics	.62	<.01	F(2,3710)=.42			
Gender by age				.05	.01	.85
Gender by service dates				.00	.00	.31
Step 4: Number of diagnoses	.62	<.01	F(1,3709)=65.48***			
Number of diagnoses				1.26	.10	8.09***
Step 5: Other client characteristics	.63	.01	F(3,3706)=15.50***			
Homeless				.52	.02	1.75
Runaway				-.03	.00	-.07
Criminal justice system -involved				2.53	.07	6.48***

*p < .05, **p < .01, ***p < .001

Table VII. Hierarchical Multiple Regression on Medical Service Referrals

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Medical Service Referrals (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.46	.46	F(11,3720)=286.06***			
Site				---	---	---
Number of service dates				.00	.17	10.44***
Number of days in program				.22	.54	34.17***
Step 2: Background characteristics	.48	.02	F(8,3712)=21.51***			
Gender				.32	.03	2.32*
Age				-.13	-.08	-5.87***
African American				.29	.02	.77
Asian American				-.41	-.01	-.83
Caucasian				-.52	-.05	-1.45
Hispanic				1.52	.11	4.01***
Native American				1.07	.02	1.71
Multi-racial				-.32	-.01	-.71
Step 3: Two-way interactions with background characteristics	.49	.01	F(2,3710)=35.73***			
Gender by age				-.02	.00	-.39
Gender by service dates				.08	.11	8.45***
Step 4: Diagnosis variables	.50	.01	F(3,3707)=26.19***			
HIV				.18	.01	.60
Mental health				-.17	-.01	-.95
Substance abuse				1.34	.12	8.78***
Step 5: Dual diagnosis	.51	.01	F(3,3704)=7.33***			
HIV by mental health				1.76	.04	3.45**
HIV by substance abuse				1.12	.03	2.78**
Mental health by substance abuse				-.45	-.01	-1.23
Step 6: Triple diagnosis	.51	<.01	F(1,3703)=.11			
HIV by mental health by substance abuse				-.33	.00	-.33
Step 7: Other client characteristics	.51	<.01	F(3,3700)=6.60***			
Homeless				-.04	.00	-.20
Runaway				.39	.02	1.42
Criminal justice system-involved				1.05	.05	4.01***
B. Hierarchical Multiple Regression on Client Characteristics for Medical Service Referrals (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.46	.46	F(11,3720)=286.06***			
Site				---	---	---
Number of service dates				.22	.54	34.17***
Number of days in program				.00	.17	10.44***
Step 2: Background characteristic	.48	.02	F(8,3712)=21.51***			
Gender				.32	.03	2.32*
Age				-.13	-.08	-5.87***
African American				.29	.02	.77
Asian American				.41	-.01	-.83
Caucasian				-.52	-.05	-1.45
Hispanic				1.52	.11	4.01***
Native American				1.07	.02	1.71
Multi-racial				-.32	-.01	-.71
Step 3: Two-way interactions with background characteristics	.49	.01	F(2,3710)=35.73***			
Gender by age				-.02	.00	-.39
Gender by service dates				.08	.11	-8.45***
Step 4: Number of diagnoses	.50	.01	F(1,3709)=37.64***			
Number of diagnoses				.64	.09	6.14***
Step 5: Other client characteristics	.50	<.01	F(3,3706)=5.33**			
Homeless				.10	.01	.50
Runaway				.10	.00	.35
Criminal justice system-involved				1.01	.05	3.84***

*p < .05, **p < .01, ***p < .001

Table VIII. Hierarchical Multiple Regression on Collateral Service Referrals

Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
A. Hierarchical Multiple Regression on Collateral Service Referrals (Multiple Diagnosis Model)						
Step 1: Site and service episodes	.30	.30	F(11,3720)=142.02***			
Site				---	---	---
Number of service dates				.00	.10	5.71***
Number of days in program				.16	.46	25.83***
Step 2: Background characteristics	.30	<.01	F(8,3712)=.62			
Gender				.07	.01	.52
Age				-.01	-.01	-.5
African American				-.08	-.01	-.21
Asian American				-.22	-.01	-.46
Caucasian				.02	.00	.06
Hispanic				.31	.03	.84
Native American				.09	.00	.15
Multi-racial				.13	.01	.29
Step 3: Two-way interactions with background characteristics	.30	<.01	F(2,3710)=6.58**			
Gender by age				-.02	-.01	-.41
Gender by service dates				.04	.05	3.62***
Step 4: Diagnosis variables	.33	.03	F(3,3707)=64.98***			
HIV				3.72	.27	12.91***
Mental health				.25	.02	1.42
Substance abuse				.60	.06	4.07***
Step 5: Dual diagnosis	.34	.01	F(3,3704)=18.94***			
HIV by mental health				2.50	.07	5.11***
HIV by substance abuse				1.69	.06	4.34***
Mental health by substance abuse				.52	.02	1.46
Step 6: Triple diagnosis	.35	.01	F(1,3703)=3.69			
HIV by mental health by substance abuse				1.90	.03	1.92
Step 7: Other client characteristics	.35	<.01	F(3,3700)=5.87**			
Homeless				.21	.02	1.12
Runaway				-.34	-.02	-1.27
Criminal justice system-involved				1.00	.06	3.99***
B. Hierarchical Multiple Regression on Client Characteristics for Collateral Service Referrals (Burden Model)						
Model Step	Model Summary			Individual Model Effects		
	R ²	R ² Change	F Change	B	β	t
Step 1: Site and service episodes	.30	.30	F(11,3720)=142.02***			
Site				---	---	---
Number of service dates				.16	.46	25.83***
Number of days in program				.00	.10	5.71***
Step 2: Background characteristic	.30	<.01	F(8,3712)=.62			
Gender				.07	.01	.52
Age				-.01	-.01	-.51
African American				-.08	-.01	-.21
Asian American				-.22	-.01	-.46
Caucasian				.02	.00	.06
Hispanic				.31	.03	.84
Native American				.09	.00	.15
Multi-racial				.13	.01	.29
Step 3: Two-way interactions with background characteristics	.30	<.01	F(2,3710)=6.58**			
Gender by age				-.02	-.01	-.41
Gender by service dates				.04	.05	3.62***
Step 4: Number of diagnoses	.31	.02	F(1,3709)=81.67***			
Number of diagnoses				.91	.15	9.04***
Step 5: Other client characteristics	.32	<.01	F(3,3706)=4.18*			
Homeless				.25	.02	1.28
Runaway				-.59	-.03	-2.24*
Criminal justice system-involved				.73	.04	2.84**

*p < .05, **p < .01, ***p < .001

Table IX. Event History (Cox Regression) Analyses on Client Characteristics Program Retention Rates^a

Model Step	Model Summary	Individual Model Effects				
	χ^2 Change	R	Wald Test	B	Exp (B)	95% CI for Exp (B)
A. Event History (Cox Regression) Multiple Diagnosis Model						
Step 1: Site and service episodes	$\chi^2(10)=1128.23^{***}$					
Site		---	---	---	---	---
Number of service dates		-.09	374.00 ^{***}	-.07	.93	.93-.94
Step 2: Background characteristics	$\chi^2(8)=23.38^{**}$					
Gender		-.01	6.01*	-.09	.91	.85-.98
Age		.01	4.87*	.01	1.01	1.00-1.03
African American		.00	.01	.01	1.01	.82-1.24
Asian American		.00	.04	.01	1.01	.91-1.12
Caucasian		.00	.90	.06	1.06	.94-1.19
Hispanic		-.01	3.51	-.28	.75	.56-1.01
Native American		.00	2.90	.17	1.19	.97-1.44
Multi-racial		.00	2.54	.15	1.16	.97-1.38
Step 3: Two-way interactions with background characteristics	$\chi^2(2)=48.84^{***}$					
Gender by age		.00	.00	.00	1.00	.98-1.02
Gender by service dates		-.03	42.66 ^{***}	-.05	.95	.94-.97
Step 4: Diagnosis variables	$\chi^2(3)=61.58^{***}$					
HIV		-.03	33.17 ^{***}	-.56	.57	.47-.69
Mental health		-.02	13.79 ^{***}	-.18	.83	.76-.92
Substance abuse		-.01	5.67*	-.10	.91	.83-.98
Step 5: Dual diagnosis	$\chi^2(3)=2.85$					
HIV by mental health		.00	.00	.00	1.00	.74-1.36
HIV by substance abuse		.00	2.78	.20	1.22	.97-1.55
Mental health by substance abuse		.00	.00	.00	1.00	.82-1.21
Step 6: Triple diagnosis	$\chi^2(1)=1.86$					
HIV by mental health by substance abuse		.00	1.89	-.42	.65	.36-1.20
Step 7: Other client characteristics	$\chi^2(3)=14.26^{**}$					
Homeless		-.01	9.33 ^{**}	-.17	.84	.76-.94
Runaway		.00	2.09	-.11	.90	.77-1.04
Criminal justice system-involved		.00	.00	.00	1.00	.87-1.16
B. Event History (Cox Regression) Burden Model						
Model Step	Model Summary	Individual Model Effects				
	χ^2 Change	R	Wald Test	B	Exp (B)	95% CI for Exp (B)
Step 1: Site and service episodes	$\chi^2(10)=1128.23^{***}$					
Site		---	---	---	---	---
Number of service dates		-.09	374.00 ^{***}	-.07	.93	.93-.94
Step 2: Background characteristic	$\chi^2(8)=23.38^{**}$					
Gender		-.01	6.01*	-.09	.91	.85-.98
Age		.01	4.87*	.01	1.01	1.00-1.03
African American		.00	.01	.01	1.01	.82-1.24
Asian American		.00	.04	.01	1.01	.91-1.12
Caucasian		.00	.90	.06	1.06	.94-1.19
Hispanic		-.01	3.51	-.28	.75	.56-1.01
Native American		.00	2.90	.17	1.19	.97-1.44
Multi-racial		.00	2.54	.15	1.16	.97-1.38
Step 3: Two-way interactions with background characteristics	$\chi^2(2)=48.84^{***}$					
Gender by age		.00	.00	.00	1.00	.98-1.02
Gender by service dates		-.03	42.66 ^{***}	-.05	.95	.94-.97
Step 4: Number of diagnoses	$\chi^2(1)=42.53^{***}$					
Number of diagnoses		-.03	41.31 ^{***}	-.18	.83	.79-.88
Step 5: Other client characteristics	$\chi^2(3)=14.48^{**}$					
Homeless		-.01	9.83 ^{**}	-.17	.84	.75-.94
Runaway		-.00	2.00	-.11	.90	.78-1.04
Criminal justice system-involved		.00	.05	.02	1.02	.88-1.17

^aIn this event history (Cox regression) analysis, the coefficient R is like a partial correlation/regression coefficient between the predictor and survival in the program. Coefficients with a negative sign are associated with program retention. For the odds ratios (Exp (B)), the values shown are for dropping out of the program; consequently, odds ratios less than 1 mean that the characteristic contributes to staying in the program.

*p < .05, **p < .01, ***p < .001

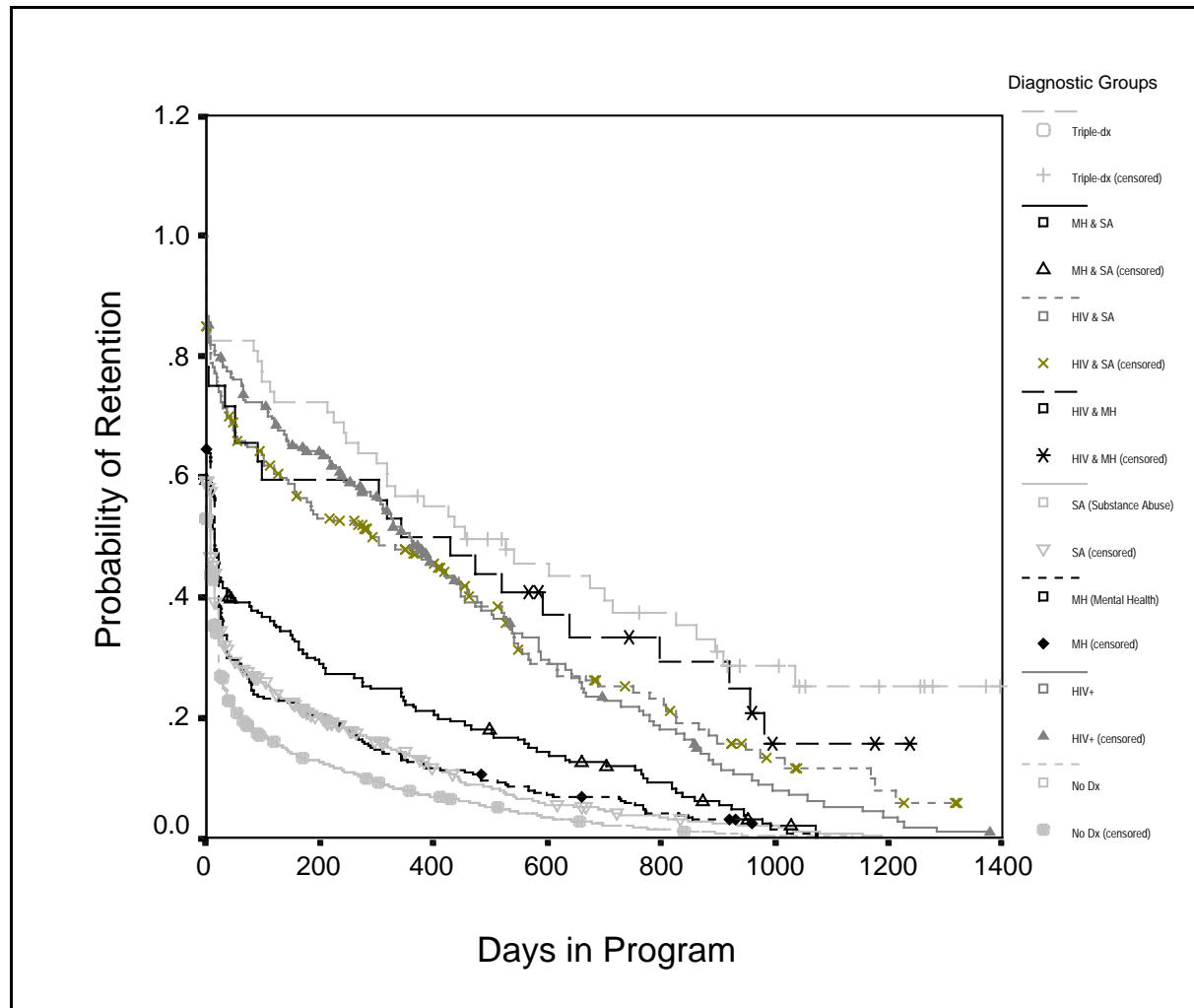


Fig. 1. Probability of Remaining in the Program for the Indicated Number of Days for Multiple Diagnosis Model

Note. Probability of remaining in the program for the indicated number of days. All clients in all programs are combined in this analysis.

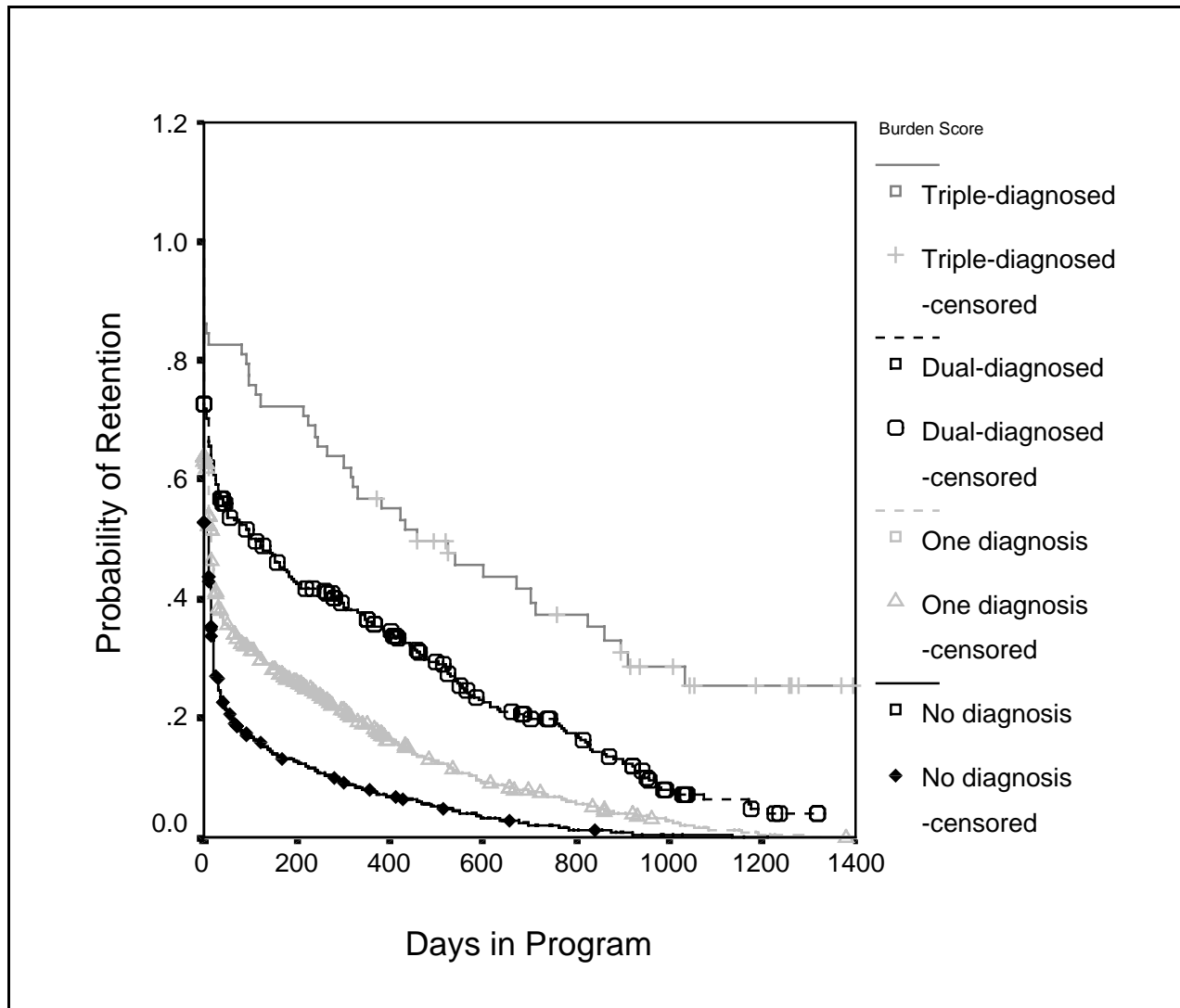


Fig. 2. Probability of Remaining in the Program for the Indicated Number of Days for Burden Model

Note. Probability of remaining in the program for the indicated number of days. All clients in all programs are combined in this analysis