AIDS HOME AND COMMUNITY – BASED WAIVERS: EFFECTS ON USE OF SERVICES, EXPENDITURES AND SURVIVAL

by

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Aids Home and Community-Based Waivers: Effects on Use of Services, Expenditures and Survival

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ABSTRACT

State Medicaid home and community-based waiver programs for persons with AIDS (PWAs) were implemented with the expectation that PWAs would use home and community-based services in lieu of more expensive hospital-based care. If so, then Medicaid spending per PWA should decline and this in turn should generate program cost savings. While some published research indicates that waiver participants incur lower expenditures than non-participants, this evidence is based on data which pre-dates the development of highly effective but expensive antiretroviral combination therapies. In this study, we analyzed Florida Medicaid claims data for PWAs from December 1995 through December 1997 to determine how participation in the home and community-based waiver affects the use of inpatient services, the receipt of antiretroviral combination therapies, monthly expenditures and survival of PWAs. Importantly, antiretroviral combination therapies were available to Medicaid recipients with AIDS throughout this time period. Four important findings are obtained. 1) the waiver program offers a different form of care to PWAs; waiver participants are more likely to receive combination therapies, but are less likely to use hospital-based care relative to non-participants. 2)The waiver is not randomly selected by PWAs; white men and sicker patients are much more likely to join the waiver program than other eligible PWAs. 3) After controlling for the non-random selection of the waiver and other patient characteristics, monthly expenditures for waiver participants are 49% lower than non-participants. 4) Waiver participation does not significantly affect survival.

I. Introduction

The prognosis, survival and quality of life for persons living with HIV/AIDS (PLWHAs) have improved dramatically in recent years due to the development of highly active antiretroviral drug therapies (Palella, et al., 1998; Hogg et al., 1998). Concomitantly, advances in medical treatment have enabled the majority of PWLHAs to obtain care on an outpatient basis or in their home. Currently, state Medicaid programs are the primary payers of medical care services for PLWHAs. To illustrate, Medicaid spending on care for PLWHAs amounted to about $3.3 billion in 1997, compared to $1.3 billion by Medicare and around $1.2 billion under the Ryan White CARE ACT (Sambamoorthi et al., 1999). In an effort to control increasing Medicaid expenditures, yet simultaneously provide high quality care, a number of state Medicaid programs implemented home and community-based waiver initiatives for persons with AIDS (PWAs) during the early 1990s. Initially authorized under section 2176 of OBRA 1985, the Medicaid 1915c waiver enables states to expand the array of home and community-based services that are available to Medicaid beneficiaries with AIDS. Waiver services are regarded as an add-on, that is, an additional bundle of 15 to 20 services such as meals-on-wheels, personal care services, or chores that are not available to beneficiaries under the traditional Medicaid program. The presumption behind this initiative is that if home and community-based waiver services are used in lieu of inpatient services then waiver participants should incur lower expenditures than non-waiver participants, and State Medicaid programs should realize cost savings.

This presumption is questionable for at least two reasons. First, empirical evidence from evaluations of home-care waiver programs for elderly Medicare beneficiaries suggests that home and community-based care tends to complement rather than substitute for inpatient services and thus results in higher costs per beneficiary (Lindsey, Jacobsen and Pascal, 1990). Second, although AIDS-specific waivers are currently functioning in 16 States, only a few published studies have evaluated the impact of waiver enrollment on utilization of services, monthly

patient expenditures and outcomes (Anderson and Mitchell, 1997; Merzel et al., 1992; Crystal, Sambamoorthi and Lo Sasso., 1998; Mitchell and Anderson, 2000). These studies found that monthly expenditures and use of inpatient services are lower for waiver participants than for either a control group of non-waiver participants or the entire population of PWAs. Nonetheless, with the exception of the recent study by Mitchell and Anderson (2000), these studies are based on data which pre-date the development of highly effective antiretroviral therapies for the treatment of HIV/AIDS. Thus, it is unclear whether home and community-based waiver initiatives for PWAs are able to generate cost savings in this era of highly effective but expensive drug treatment regimens.

In this study, we analyze Florida Medicaid eligibility and claims data for PWAs spanning the years 1996 through 1997 to evaluate how participation in the Medicaid waiver program for PWAs affects the types of services received by patients, monthly patient expenditures, and health. Importantly, antiretroviral combination therapies were available to Medicaid recipients with AIDS throughout the time period. First, we examine whether persons who choose to participate in the waiver program in Florida are more or less likely to receive antiretroviral combination drug therapies and inpatient care. Second, we also examine whether waiver enrollment has any impact on monthly patient expenditures and survival. Considering that the waiver offers a bundle of home and community based services that are not readily available to other Medicaid beneficiaries with AIDS, we expect to find significant differences in the types of services used by waiver participants in comparison to those not enrolled in the waiver. These services may be viable alternatives to costly inpatient care. We do not know, however, whether waiver patients are more or less likely to receive recent combination drug therapies and whether the overall treatment packages differentially affect survival and/or monthly patient expenditures.

The remainder of this paper is organized as follows. The second section provides a brief synopsis of the relevant literature. Section three describes the data, sample inclusion /exclusion criteria and variable construction. Section four outlines the estimation strategy. In section five we report the results. A final section contains concluding remarks.

II. Literature Review

Empirical evaluations of Medicare home and community-based waiver initiatives for elderly persons suggest that home and community-based services tend to complement rather than substitute for institutional care and thus result in higher costs per beneficiary (Lindsey, Jacobson and Pascal, 1990). However, this conclusion may not be applicable to home and community-based waivers designed for PWAs for at least three reasons. First, previous research failed to account for the possible non-random selection of home and community-based services in evaluating the impact of the waiver on costs. Second, waiver initiatives for the elderly were designed to deter the use of nursing home care. In contrast, services available under AIDS-specific waivers are supposed to substitute for more expensive inpatient care. Finally, the elderly and AIDS populations differ with respect to demographic composition, services received and disease duration. This suggests that findings based on elderly populations are probably not applicable to PWAs (Weissart, Cready and Pawalek, 1988).

The limited research that has evaluated the effects of enrollment in AIDS-specific home and community-based waiver initiatives suggests that these programs yield cost-savings. For example, Merzel et al. (1992) examined the New Jersey waiver experience and estimated average monthly treatment costs per Medicaid enrollee of $2,400 in 1988; they concluded that the average costs for PWAs enrolled in the waiver were substantially lower than the $5,000 monthly estimate suggested by previous studies. In a more recent yet unpublished study, Crystal, Sambomoorthi and LoSasso (1998) also examined the impact of the New Jersey Medicaid home and community-based waiver program on the costs of care, use of inpatient and outpatient services, and access to care. Their multivariate analyses based on Medicaid data for

PWAs diagnosed between 1988 and 1992 show that New Jersey waiver participants utilized substantially fewer inpatient services and more outpatient services in comparison to those receiving traditional care, yet there was no difference in overall monthly costs of care between the two groups. Further, waiver participation appears to reduce socioeconomic differences in access to outpatient services. Using more recent data from the New Jersey AIDS waiver, Sambamoorthi et al. (1999) compared the use and costs of home-care between waiver and non-waiver enrollees. Their findings suggest that waiver participation appears to reduce racial and risk group differences in the probability of using home care, although injection drug users were less likely to participate in the waiver. Irrespective of waiver enrollment, injection drug users incurred significantly lower monthly home-care expenditures.

The only other evaluations of Medicaid AIDS-specific waiver compare participants and non-participants in Florida. Anderson and Mitchell (1997) found that, after controlling for program selection, PWAs enrolled in the home and community-based waiver in Florida during its first two years of operation (1990-1991), incurred monthly Medicaid expenditures that were 22-27% lower than non-participants. Using more recent data for the years 1993 through 1997, Mitchell and Anderson (2000) evaluated the effects of waiver participation and recently developed antiretroviral drugs on monthly expenditures for Florida Medicaid recipients with AIDS. They found that, after controlling for gender and race/ethnicity, monthly Medicaid expenditures for non-waiver participants were significantly higher than for waiver enrollees. The major reason for the cost difference is that non-waiver enrollees incurred higher inpatient costs than PWAs enrolled in the waiver. Although waiver participants incurred higher drug expenditures, these drug costs represent only a fraction of the higher inpatient costs incurred by non-waiver enrollees. While their analyses are the first to evaluate the impact of the recently developed AIDS drugs on patient costs, they provide only indirect estimates because they examined a time period that includes three years prior to and two years after the availability of combination therapies. To directly measure the impact of the new antiretroviral therapies on patient costs, one should focus solely on the time period during which these drug treatments were

available. Furthermore, their more recent analysis is descriptive and thus does not control for the waiver selection and other confounding factors.

Our study attempts to address the limitations of existing research by examining the effects of waiver participation on the use of services, monthly patient expenditures and survival during a time period when the antiretroviral combination therapies were available to Medicaid recipients.

III. The Data and Sample Construction

The data for this research came from records of Medicaid claims for medical services in Florida that were delivered between January 1, 1993 and December 31, 1997. All claims were screened for diagnosis codes or prescribed drugs used to treat HIV/AIDS related illness. The population of Florida Medicaid recipients with HIV/AIDS was identified using a protocol developed by staff of the Florida Medicaid program in conjunction with clinical advice from physicians who specialize in the treatment of AIDS. We recognize that identifying persons with HIV/AIDS related illness from claims data is a difficult task. Although Medicaid program staff refined this algorithm extensively during the course of its development, there may be a few cases in our sample who do not actually have HIV/AIDS. The specific algorithm developed by Florida Medicaid program staff involves extensive lists of diagnosis and procedure codes and for this reason is not reported in detail here. This algorithm is available upon request from the authors.

A. Sample Inclusion/Exclusion Criteria

Records are available for every person in the state who filed at least one Medicaid claim during the period 1993-1997 and is HIV positive or has full-blown AIDS. In this study, we focus on the treatment of adults and thus exclude all claims for persons on Medicaid who are less than age 18. If a Medicaid recipient turned 18 between 1993-1997, we included this person in our analysis but excluded all claims filed at ages less than 18. We also exclude all persons who, between January 1993 and December 1997, turned age 65. Our rationale for this exclusion is that we do not want to confound our analysis of Medicaid with the switch to Medicare at older ages. Finally, we focus the analysis on Medicaid recipients with AIDS who are white, black, and Hispanic. Thus, we exclude Medicaid recipients who are classified as "Other Race".

The first recorded claim for a combination drug therapy among the patients who meet these criteria occurs in December 1995. Because we are interested in differential access to these therapies, we further limit our analysis to only PWAs who entered the Medicaid program prior to December 1995 and survived through December 1995. Hence, our analyses are only based on claims filed for services rendered to individuals when combination therapies were available throughout the period. After making these exclusions, the final sample includes 10,836 PWAs enrolled in the Florida Medicaid program.

B. Variable Construction

For each person in our database, we have records for each month in which a claim for Medicaid services is filed. Each record contains information about the claim as well as basic demographic information about the patient. Claims information includes the number and types of services provided, pharmaceuticals prescribed, amounts paid by Medicaid for services and drugs, diagnosis codes and date of death. Demographic information includes age, race, gender, and county of residence. We have no information on diagnosis codes prior to January 1993; we, therefore, cannot determine the month in which they are first diagnosed with HIV or AIDS if they are on Medicaid prior to January 1993. We also have no information on income or

employment of recipients and their families at any point in time. We construct proxy measures from information on county per capita income and county urbanization.

We collapse the claims records for each person so that we have one record per person. This file contains information on waiver enrollment and our three categories of dependent variables – treatments received, expenditures, survival – and our independent variables. Utilization is measured with two variables. Inpatient care is a dummy variable equal to one if the patient has experienced one or more hospitalizations. Combination drug therapy is also measured with a dummy variable equal to one if the therapies were ever prescribed and received during the same two year period. Total expenditures are measured from December 1995 through December 1997; average monthly expenditures are equal to total expenditures over this period divided by the number of months that the patient was alive during this same period. In the expenditure models, we use the log of average monthly expenditures to adjust for skewness that typically exists with Medicaid expenditure data. Only persons with positive claims during the December 1995 through December 1997 period are included in the expenditure analyses. Survival is measured over the period of time in which combination drug therapies are available. All PWAs in our sample survived through December 1995 when combination therapies became available to Medicaid patients in Florida. Our survival measure is, therefore, the number of months alive from December 1995 until date of death or December 1997, the last point of observation.

We relied on our physician consultant, Paul Arons, M.D. of the Bureau of HIV/AIDS of the Florida Department of Health, to guide us in constructing the drug treatment regimens for HIV/AIDS. During the study period, there were three types of drugs used to treat HIV infection: nucleoside analogs, non-nucleoside analogs, and protease inhibitors. The five nucleoside analogs available during the study period were: zidovudine (azt), didanosine (ddi), zalcitabine (ddc), stavudine (d4t), and lamivudine (3tc). The two non-nucleoside analogs available were nevirapine and deavirdine. Furthermore, there were five protease inhibitors available to Medicaid recipients during the study period: saquinavir, ritonavir, indinavir, and nelfinavir.

Drugs from these three groups are used in combination with each other to reduce HIV viral load and to increase the amount of CD4 lymphocyte cells. Recommended treatment for PLWHAs with antiretrovirals was published in two concensus statements issued by a panel of HIV/AIDS experts (Carpenter et al., 1996; Carpenter et al., 1997). In Florida, the single drug therapies (nucleoside analogs and non-nucleoside analogs) were available to Medicaid patients in 1993, while the combination therapies were not available until December 1995.

Using the pharmaceutical claims on each patient between December 1995 and December 1997, we identified individuals who received either of the following two combinations: 1) Two nucleoside analog drugs; these include zidovudine (azt), didanosine (ddi), zalcitabine (ddc), stavudine (d4t), and lamivudine (3tc); 2) One protease inhibitor and a pair of nucleoside analogs. (Physicians may substitute a non-nucleoside analog for a protease inhibitor if a patient develops a resistance to a protease inhibitor.) The drug therapy variable is equal to one if any claim during the period of study indicated either (1) or (2).

Waiver participation is a dummy variable equal to one if the patient was enrolled in the waiver during the patient's last month in the data. Those persons who were not enrolled in the waiver also had at least one claim for inpatient care at some point between January 1993 and December 1997. This is an appropriate control group because the waiver is only available to PWAs deemed to be at risk of hospitalization.

The exogenous variables in our models include demographic characteristics, community characteristics, and stage of disease. The demographic characteristics are: race, gender, age at first claim, and county characteristics for county of last claim. Race/ethnicity is measured with two dummy variables for black or Hispanic; white is the omitted category. Gender is a dummy variable equal to one if the patient is female. Age is measured in years. County characteristics include median per capita income and percentage of the county population residing in urban areas. In the waiver selection and input choice models, we also control for other characteristics

of the county which influence the choice of home and community-based care: pharmacies per Medicaid patient, home health care agencies per population, and hospices per population.

We do not have laboratory data with which to measure the severity of AIDS in each patient. However, the claims record contains detailed diagnosis information which we used to construct three indicators of patient health. We measure the state of health at the beginning of our analysis period – December 1995. This state of health at the start of the period is, therefore, exogenous to the choice of the waiver and the types of services received during the 1996-1997 period.

The first health variable attempts to capture the severity of AIDS. Using the information reported in the diagnosis code field on each claim, we extract the 32 AIDS defining diagnoses identified by HIV/AIDS physicians; these diagnoses were employed in the screening algorithm developed by Medicaid program staff. We construct 32 dummy variables indicating whether the PWA ever had a diagnosis of each condition prior to December 1995. We then assumed that these indicators (I) are jointly and linearly related to the latent AIDS health outcome (A) as follows: $I = A B' + .$ where B is a vector of weights and . is random error. We employed factor analysis to construct an index A based on estimation of this model. This index proxies for severity of disease, with higher values representing greater severity. The factor loadings and the scoring coefficients for these AIDS health indicators for the first common factor are given in Appendix Table A.1, where factor loadings are the B weights above. For regression scoring in the orthogonal case, the estimate of the first factor is $A = .' \square^{-1} \square$ where $\square$ is the correlation matrix of $\square$. All but three of the factor loadings are positive indicating a positive relationship between the indicator and the underlying latent variable A.

The second health variable is designed to reflect the presence of other comorbidities. To control for other comorbidities, we construct a series of 15 dummy variables to identify the following broad categories of health conditions: infectious disease, malignant neoplasm, immunity problem, blood disease, nervous system disorder, circulatory problem, respiratory problem, pneumonia (not AIDS related), digestive system problem, genitourinary problem, skin

problem, musculoskeletal problem, drug dependency, other symptoms as yet undiagnosed, and injuries. We have many reported diagnoses from the first claim through December 1995. We collapse all of these reported diagnoses over the 1993-1995 period into dummy variables. To develop an index of "Other Comorbidities", we again employ factor analysis. In this case, I above is the set of indicators of Other Health problems. We extract the first common factor from this analysis and use this as our measure of Other Health. The factor loadings and scoring coefficients are reported in Appendix Table A.2.

Third, we construct a separate dummy variable to identify women who were pregnant at some point during the three year time period before December 1995. This variable is equal to one if a female PWA was ever pregnant during 1993-1995 and is equal to 0 if she was not pregnant or if the PWA was male.

IV. Empirical Models

In this section we describe the models that we use to estimate the effect of waiver participation on treatments received, expenditures and survival. We assume that participation in the waiver by PWAs is not random so that the residuals in a waiver choice model would be correlated with the residuals in the treatments received, expenditure and survival models. Careful modeling of the choice of the waiver is critical in order to obtain unbiased estimates of the effect of waiver enrollment on either treatments received, expenditures or survival. The first step in our analysis is, therefore, to estimate a model of waiver participation.

We assume that waiver participation (W), and therefore the treatments received, are affected by the characteristics of the patient and the availability of comparable services in the community. The characteristics of the patient (X) include race, gender, age, and health. The vector X also includes measures of county income and urbanization to proxy for household resources. The variables which identify selection of the waiver include the availability of pharmacies, hospices, and home health care agencies in the county (Z). The empirical constructs for X and Z are described above. We expect to find greater waiver participation in urban areas

and higher income counties than in other counties relative to rural areas and lower income counties. We also expect to find lower enrollment in the waiver if the county has many available home and community-based alternative services such as hospices, home health care agencies and pharmacies. These organizations would be able to provide more information and more choices for patients in the absence of Medicaid waiver services. We estimate the model of waiver participation using probit analysis.

Our analysis evaluates the effect of waiver participation on two types of services: the use of inpatient care (H) and the receipt of combination drug therapies (D). H and D are affected by patient and community characteristics (X) and by participation the waiver (W). Because D and H are each dichotomous variables, we estimate two simultaneous probit models. The first estimates selection of the waiver (W) and the use of inpatient care, while the second estimates waiver enrollment and receipt of combination drug therapies (Maddala, 1983) We first estimate reduced form models of waiver selection (W), use of inpatient care (H) and the receipt of combination therapies (D). We then estimate the probability of waiver selection from the reduced form and use this estimate in structural models of use of inpatient care (H) and receipt of combination therapies (D). Given that choice of the waiver is associated with a different package of services compared to those available under traditional care, or both simultaneous probit equations, we rely on nonlinearities to identify the model.

The next model we estimate is the log of monthly expenditures. We estimate both OLS and IV models; the latter recognizes that waiver participation is an endogenous right-hand side variable. In the expenditure model, we use the availability of hospice care in the county, home health agencies per population in the county and pharmacies per Medicaid recipient in the county as identifying variables.

The health outcome of interest is patient survival (S), measured as the number of months alive from December 1995 through December 1997. S is assumed to depend on the characteristics of the patient (X) and the selection of the waiver (W). We estimate three models of survival. In the first model, we estimate a model of log duration (log S) using standard

regression. We assume, in this model, that waiver selection is exogenous. In the second model, we control for the endogeneity of waiver participation and estimate the log duration model using instrumental variables estimation. The instrument for waiver participation is the predicted probability of participation W* obtained from the probit model of waiver participation described above. Waiver participation is identified through the measures of the relative availability of hospice, home health agencies and pharmacies in the county of residence.

The regression model of log duration does not control for the probability that the patient has an incomplete lifetime by December 1997. To allow for censoring, we also estimate our survival using a Weibull hazards model. In the Weibull model, h_0 (the baseline hazard) is assumed to be equal to pt^{p-1}; if p is greater than one, then the hazard increases with duration or the probability of death increases over time. The waiver variable in the hazard model is the predicted probability of waiver participation derived from the probit model.

V. Empirical Results

A. Descriptive Evidence

Table 1 reports descriptive statistics for all PWAs and then stratifies the sample by waiver

participation. About half of the 10,836 persons in the sample are enrolled in the waiver.

As anticipated, use of services varies significantly between waiver and non-waiver enrollees. Waiver participants are much more likely to use combination drug therapy (59%) compared to only 25% of non-waiver enrollees. The reverse holds for inpatient care; close to 35% of waiver participants use inpatient care compared to almost 66% of non-waiver participants. These differences in the use of services have implications for expenditures. On average, expenditures during the two year period are $1290 a month among all patients. After controlling for waiver enrollment, it appears that average monthly expenditures of waiver participants are $1622 compared to $961 for non-waiver participants. This significant difference in monthly expenditures is linked to differences in the services provided to patients in the two groups.

Monthly expenditures on drugs are about $600 higher among waiver participants while their expenditures on inpatient care are only $150 lower. These differences explain most of the observed differential in average expenditures between the two groups of patients.

Between 1996-1997, about 17 percent of these patients die, and the average survival time is 22 months. We find that waiver participants are more likely to die before December 1997 than non-waiver participants and non-waiver participants live, on average, two months longer than waiver participants; 22 percent of waiver participants die during the interval and 12.5 percent of non-waiver participants die. However, based on our indices of health, we find that waiver participants are in worse health and are much less likely to have been pregnant. This suggests that sicker patients are selecting the waiver program, and this selection may be driving the mean differences in survival that we observe.

As regards race/ethnicity, about 42 percent are black, 8 percent are hispanic, and 50 percent are white. Women account for 47 percent of PWAs. The average age of patients is 38, and over 80 percent report living in urban areas of their counties. Waiver and non-waiver participants differ in these demographic characteristics. Waiver participants are more likely to be white and male than non-waiver participants. Only 26% of waiver participants are female compared to 67% of non-waiver participants. The majority of waiver participants are white (58%) compared to 43% of non-waiver enrollees. Waiver participants are about 3 years older on average than non-waiver participants and are more likely to live in urban areas.

The descriptive evidence indicates that the waiver is not randomly selected by patients but is more likely to be chosen by white men and sicker patients than is traditional care. This suggests that some groups of PWAs – in particular, women and blacks – may have less information about the waiver option and its relative benefits. We also find evidence that receipt of combination drug therapies, use of inpatient care, expenditures and survival vary by waiver status. Whether participation in the waiver actually does increase expenditures and lower survival cannot be determined from these descriptive results, however, because we have not as yet controlled for the differential effect of health and individual patient characteristics on these

outcomes. The results of our multivariate analyses which control for the non-random selection of the waiver option on use of services, expenditures and survival are reported below.

B. Probit Estimates of Waiver Selection, Combination Drug Therapy, and Inpatient Care

Table 2 presents estimates of the single equation probit models of waiver participation, the receipt of inpatient care and the receipt of combination therapies. The table also contains the simultaneous probit estimates predicting the propensities to receive inpatient care or combination therapies. With the exception of age and local urban population, all the variables are significant determinants of waiver participation. As suggested by the descriptive statistics, white men are more likely to choose the waiver than other demographic groups. We also find that the higher the severity of the AIDS condition as measured by our AIDS health index, the more likely the PWA is to join the waiver. Persons with a higher score on the Other Comorbidites index and women who have been pregnant are less likely to enroll. The effect of Other Comorbidities on waiver selection is much weaker than the effect of AIDS severity.

Community characteristics are also important to the selection of the waiver. The waiver is more likely to be chosen by PWAs residing in wealthier counties in Florida. We also find that PWAs who reside in counties with greater availability and access to home health agencies and pharmacies are less likely to join the waiver. The reverse holds for PWAs who reside in counties with greater access to hospice care. While these findings suggest that home health services and pharmacies are substitutes for waiver services, it appears that hospice services may be complementary with waiver care.

Using these estimates of waiver participation, we next evaluate the effect of the waiver on the type of care received by patients. In particular, we estimate the impact of waiver participation on the receipt of combination drug therapies and the use of inpatient care. From Table 2, we find that there are significant effects of waiver participation on the type of care

received. Waiver participants are significantly more likely to receive combination drug therapy but are significantly less likely to receive inpatient care relative to non-waiver participants. This suggests that waiver services are a substitute for inpatient care yet they appear to be complementary to the receipt of antiretroviral drug therapy. These results are significant and are consistent with the descriptive statistics in Table 1.

We find that both the receipt of drug therapy and inpatient care vary with demographic characteristics and patient health status. In the reduced form and structural models, women are less likely to receive combination drug therapies but are more likely to be hospitalized than men, after controlling for health. Blacks are more likely to receive combination drug therapies than whites, although racial differences in the receipt of inpatient care received by PWAs once we control for waiver participation are negligible. Health is also an important determinant of the types of services that each patient receives. Patients with more severe cases of AIDS are more likely to obtain the combination drug therapies, although severity of AIDS has no impact on the use of inpatient care. Patients who score higher on the Other Comorbidities index and women who have ever been pregnant are less likely to receive either drug therapy or inpatient care. County characteristics also have some impact on the care received. Patients in counties with more hospice care are less likely to receive combination therapy or inpatient care while patients in counties with more home health agencies are more likely to receive both drug therapy and inpatient care. Pharmacy availability is associated with a lower probability of inpatient care, yet it has no impact on the odds of receiving combination therapy.

C. Waiver Enrollment and Average Monthly Expenditures

To determine whether the waiver is a less expensive treatment option than standard care, we next examine the costs of this treatment per month using Medicaid expenditures as our measure of cost. The expenditure models are presented in Table 3. We find that waiver enrollment has a positive effect on monthly costs if we assume that participation in the waiver program is exogenous. However, when we control for non-random participation in the waiver

program by PWAs, we find that the waiver enrollment results in lower average monthly Medicaid expenditures. After adjusting the coefficients to account for the log dependent variable, the OLS results suggest that waiver enrollees incur monthly expenditures that are 68.5 percent higher than non-participants. In contrast, the IV results imply that monthly patient expenditures are 49 percent lower for waiver participants relative to non-participants. We also find, as expected, that expenditures are lower for women on average. Racial differences in monthly Medicaid expenditures are negligible. Sicker patients, using either index of health, are more expensive patients as expected, but women who have been pregnant are much less costly than either men or other women in our sample. Expenditures are also higher in more urban areas of the state and in counties with higher income. These community results are consistent with expectations.

D. Waiver Enrollment and Survival

Table 4 presents the results from the estimation of regression and hazards models of survival. Three models are presented in this table: OLS regression assuming waiver selection is exogenous, instrumental variables regression (IV) controlling for non-random participation in the waiver and a Weibull hazards model. The coefficients in the regression models are marginal impacts on log duration (survival from Decembe 1995-December 1997). For the hazard model, we report the odds ratios derived from the hazard model coefficients. An odds ratio greater than one indicates that the independent variable increases the probability of death, whereas an odds ratio less than one means the odds ratio is associated with a lower probability of death.

We find that waiver participation, irrespective of whether it is exogenous, endogenous or a predicted probability, has no effect on survival in either the regression or the hazard models. Thus, although waiver participants use a different package of services than their non-waiver counterparts, these differences in treatments received have no impact on survival. The descriptive statistics suggest that PWAs enrolled in the waiver survive about one month less than non-wavier participants. However, these mean differences do not control for differences in the

other characteristics of patients that may explain survival differences. Once we control for differences in other patient characteristics, we find no effect of waiver participation on survival. The survival results in combination with the finding that waiver enrollees incur lower monthly expenditures than non-waiver enrollees suggest that services available under the AIDS-specific waiver yield a significantly more cost-effective form of treatment than services available to non-waiver enrollees under the traditional Medicaid program.

Contrary to waiver enrollment, some patient characteristics are linked to differences in survival. Blacks have lower survival and a higher odds of dying then other patients. Conversely, women are less likely to die than men. We also find that sicker patients as measured by both the AIDS index and the Comorbidity index, are significantly more likely to die than less sick patients.

We find, however, a protective effect of pregnancy among women. Women who were ever pregnant prior to December 1995 were less likely to die during the 1996-1997 period. Finally, the odds of dying appear to be significantly higher in urban areas..

V. Conclusions and Policy Implications

Some state Medicaid agencies implemented AIDS-specific home and community-based waiver programs during the late 1980s and early 1990s to provide home and community-based services to PWAs as an alternative to more expensive hospital-based care. If home and community-based care is used in lieu of more expensive inpatient care, then Medicaid expenditures per AIDS patient should fall and this in turn should generate program savings. Although some published research has demonstrated that participants in AIDS waivers incur lower monthly expenditures than non-participants (Anderson and Mitchell, 1997; Merzel et al.; 1992), these studies are based on data from a time period which pre-dates the availability of recently developed antiretroviral combination therapies. In this study, we analyzed Florida Medicaid claims data for PWAs during the period December 1995 through December 1997 to evaluate the effects

of waiver participation on use of inpatient care, receipt of combination drug therapies, monthly expenditures and survival. Importantly, antiretroviral combination therapies were available to Florida Medicaid recipients with AIDS throughout this time period.

Our findings indicate that the waiver program offers a different form of treatment to PWAs; waiver enrollees receive home-based care, less inpatient care, and have greater use of combination drug therapies. The waiver is not randomly selected by eligible patients, however. White men and persons who have greater AIDS related severity are more likely to enroll in the waiver program than other patients.

Recognizing that waiver participation is a choice and thus must be modeled as an endogenous right-hand side variable has significant implications for the analyses evaluating the impact of waiver participation on monthly expenditures. After controlling for non-random selection of the waiver program through instrumental variables estimation, waiver patients are found to incur significantly lower expenditures per month than non-waiver patients. The IV estimates suggest that average monthly expenditures are almost 50% lower for waiver enrollees relative to non-participants. The differences can be attributed to lower hospitalization expenses and are detected only when we control for the nonrandom selection of the program and other characteristics of patients. The OLS estimates, which assume that waiver participation is an exogenous right-hand side variable, yield the opposite conclusion. On the other hand, waiver participation does not seem to affect, positively or negatively, the survival of PWAs. Once we control for other patient characteristics, survival is equivalent in both groups of patients.

Overall, the waiver program seems to be an efficient treatment choice. Patients who opt for this form of care are less expensive than other patients. Further, it is likely that they are receiving a more comfortable, preferable type of care based in their homes and not in institutions. The case management component of the AIDS waiver program provides each PWA with a plan of care that ensures regularity of care and promotes compliance with recommended medications. These results suggest that waiver initiatives for the treatment of AIDS are cost-effective and should be considered by Medicaid programs in other states. Moreover, home and

community-based care initiatives may also be viable policy options for providing cost-effective services to persons with other chronic health problems.

References

Anderson, K.H. and J.M. Mitchell. 1997 "Expenditures on Services for AIDS Patients Under a Medicaid Home and Community-based Waiver Program: Are Selection Effects Important?" *Medical Care*, 35(5): 425-439.

Carpentar, C.C. M.A. Fischl, S.M. Hammer et al. 1996. "Antiretroviral Therapy for HIV Infection in 1996:Recommendations of an International Panel." *Journal of the American Medical Association*,
276 (2): 146-154.

Carpentar, C.C., M.A. Fischl, S.M. Hammer et al. 1997. Antiretroviral Therapy for HIV Infection in 1997: Updated Recommendations of the International AIDS Society-USA Panel." *Journal of the American Medical Association*,277 (24): 1962-1969.

Crystal, S., U. Sambamoorthi, and A. Lo Sasso. 1998. "Impact of Case-Managed HIV Care Program on Health Care Access and Expenditures." Unpublished manuscript.

Hogg, R.S., K.A. Heath, B. Yip et al. 1998. "Improved Survival Among HIV Infected Individuals Following Initiation of Antiretroviral Therapy." *Journal of the American Medical Association*,
279: 450-454.

Lindsey, P.A., P.D. Jacobson, and A. Pascal. 1990. "Medicaid Home and Community-based Waivers for Acquired Immunodeficiency Syndrome Patients." *Health Care Financing Review*, Annual Supplement: 109-118.

Maddala, G.S. 1983. Limited-Dependent and Qualitative Variables in Econometrics, Cambridge University Press, Cambridge, England.

Merzel, C.S., S. Crystal, U. Sambamoorthi, D. Kraus, and C. Kurland. 1992."New Jersey's Medicaid Waiver for Acquired Immunodeficiency Syndrome." *Health Care Financing Review*, 13(2): 27-44.

Mitchell, J.M. and K.H. Anderson. 2000. "Effects of Case Management and New Drugs on Medicaid AIDS Spending." Forthcoming in *Health Affairs*.

Palella, F.J., K.M. Delaney, A.C. Moorman, M.O. Loveless, J. Furher, G.A. Satten, D.J. Aschman, S.D. Holmberg. 1998. "Declining Morbidity and Mortality Among Patients with Advanced HIV
Infection." *New England Journal of Medicine*, 338(13): 853-860.

Sambamoorthi, U., S.R. Collins, S. Crystal, and J. Walkup. "1999. "Home-Care Use and Expenditures Among Medicaid Beneficiaries with AIDS." *Health Care Financing Review*, 20(4): 161-177.

Table 1

Descriptive Statistics for Variables Used in the Empirical Models

	All Persons With AIDS (N=10,836)	Waiver Participants (N=5,396)	Non-Waiver Participants (N=5,440)
Dependent Variables (12/95-12/97)			
Waiver Selection	.49	–	–
Combination Drug Therapy	.415	.592	.254
Use of Inpatient Care	.50	.346	.658
Average Monthly Expenditures	$1,290 (1,887)	$1,622 (2,030)	$961 (1,670)
Average Monthly Inpatient Expenditures	$227 (758)	$155 (598)	$299 (882)
Average Monthly Drug Expenditures	$631 (1,196)	$953 (1,415)	$312 (812)
Died Afer 12/95	.172	.219	.125
Length of Survival, months	22.48	21.71	23.25
Independent Variables			
White	.50	.58	.43
Black	.42	.34	.50
Hispanic	.08	.08	.07
Female	.47	.26	.67
Per capita Income in the Zip Code	$12,764	$13,463	$12,070
Percent of Zip Code Urban	81.3	84.4	78.3
AIDS Index as of 12/95	0	.198	-.197
Comorbidity Index as of 12/95	0	-.046	.045
Pregnant before 12/95	.18	.05	.42
Hospices per Population	.017	.012	.02
Home Health Agencies per County Population	.074	.069	.08
Parmacies per Medicaid	.396	.393	.400

Table 2

Probit Models of Waiver Selection, Receipt of Combination Drug Therapy and Use of Inpatient Care[a]

Variable	Waiver Selection	Combination Drug Therapy		Inpatient Care	
		Reduced Form	Structural	Reduced Form	Structural
Black	-.150*** (.032)	.150*** (.029)	.216*** (0.39)	.978*** (.028)	.037 (.038)
Hispanic	-.465*** (.052)	-.003 (.050)	.014 (.065)	.029 (.048)	.016 (.063)
Female	-.675*** (.031)	-.345*** (.030)	-.160*** (.040)	.371*** (.030)	.175*** (.043)
Age	.0001*** (.001)	.001 (.001)	.001 (.002)	-.006*** (.001)	-.719*** (.0018)
Per Capita Income ($1000s)	.015*** (.003)	-.0003 (.003)	-.004 (.004)	-.002 (.003)	-.012 (.004)
Percent of Zipcode Urban	.031 (.047)	.308*** (.046)	.324*** (.059)	.012 (.042)	.024 (.057)
AIDS Index	.231*** (.016)	.133*** (.015)	.078*** (.020)	-.077*** (.015)	-.014 (.216)
Comorbidity Index	-.100*** (.016)	-.069*** (.015)	-.044*** (.020)	-.014 (.015)	-.050*** (.020)
Pregnant Before 12/95	-.918*** (.047)	-.541*** (.043)	-.337*** (.055)	-.329*** (.039)	-.586*** (.054)
Hospices per Populated	1.799*** (.645)	-1.634*** (.628)	-2.475*** (.804)	-1.911*** (.518)	-1.324*** (.685)
Home Health Agencies per Population	-8.563*** (.542)	.012 (.502)	2.492*** (.645)	4.441*** (.483)	2.83*** (.634)
Pharmacies per Medicaid Patient	-.446*** (.227)	-.246 (.214)	-.131 (.201)	-.679*** (.189)	-.785*** (.252)
Waiver Participant	–	–	.829*** (.029)	–	-.855*** (.030)

***Significant at the 1% level.

Note: [a]Probit coefficients and standard errors are in parentheses.

Table 3

Average Monthly Expenditures Models: OLS and IV

Variables	Log Monthly Expenditures: OLS	Log Monthly Costs: Expenditures: IV
Intercept	5.611*** (.083)	6.318*** (0.133)
Race		
Black	0.062*** (0.03)	-0.008 (0.034)
Hispanic	0.095** (0.053)	0.056 (0.058)
Gender: Female = 1	-0.238*** (0.001)	0.013*** (0.002)
Age	0.013*** (0.001)	0.013*** (0.023)
Comorbidity Index	0.252*** (0.015)	0.236*** (0.019)
Ever Pregnant = 1	-0.832*** (0.043)	-1.122*** (0.061)
Per Capita Income (divided by 1000)	0.003 (0.003)	0.009*** (0.003)
Percentage Urban	0.409*** (0.039)	0.435*** (0.042)
Waiver Participant = 1	0.522*** (0.031)	-0.672*** (0.189)
F-statistic	324.73	258.35
R-squared	0.255	0.135
Sample Size	9,510	9,510

***Significant at the 1% level.
** Significant at the 5% level.

Table 4

OLS and IV Regressions Predicting Survival;
Cox and Weibull Hazard Models Predicting the Probability of Death

Variables	OLS Coefficient (Standard Error)	IV Coefficient (Standard Error)	Weibull Hazard Odds Ratio
Waiver Participant = 1	-0.08 (.011)	0.008 (0.058)	0.877
Race			
Black	-0.062*** (.011)	-0.057*** (0.012)	1.456***
Hispanic	0.007 (.019)	0.01 (0.019)	0.868
Gender Female=1	0.069** (.012)	0.077*** (.019)	0.875***
Age	0.0008 (.0005)	0.0006*** -0.067	1.237***
AIDS Index	0.062*** (.008)	-0.067*** (.007)	1.237***
Other Health Index	-0.065*** (.006)	-0.052*** (.006)	1.276***
Ever Pregnant=1	0.100*** (.015)	0.118*** (.021)	0.321***
Per capita income (divided by 1000)	-1.00E-03 (.001)	-2.00E-03 (.001)	1.234***
Intercept	3.045 (.030)	3.002 (.028)	
Parameter p			.969***
F-Statistic	66	62.81	
R-Squared	0.057	0.054	
LR chi-squared (10)			694.38
Sample size	10,836	10,836	10,836

*** Significant at the 1% level.

Note: a p greater than 1 in Weibull hazard model indicates the probability of dying increases over time.

Appendix Table 1

Factor Loadings and Scoring Coefficients on
AIDS Severity Index

AIDS Indicators	Factor Loadings	Scoring Coefficients
Salmonella	0.05929	0.01521
TB-Other	0.28314	0.07825
TB-primary	0.11131	0.02513
Herpes	0.20045	0.04798
Cytomegalic incl. Disease	0.20778	0.05122
Candidiasis	0.34403	0.07139
Coccidiosis	0.09888	0.03203
Coccidioidomycosis	0.02951	0.00754
Histoplasmosis	0.09559	0.01598
Toxoplasmosis	0.16384	0.04067
Infectious/parasitic disease	0.78648	0.34613
Other malignant neoplasm, skin	0.10191	0.03368
Kaposi's sarcoma	0.16584	0.0436
Malignant neoplasm, cervix	-0.02687	-0.00571
Lymphoma	0.00742	0.00536
Meningitis	0.05684	0.01057
Pneumonia	0.09301	0.02253
Encephelitis	0.17386	0.04996
Malnutrition	0.12997	0.0316
Other mycobacterial disease	0.23874	0.03599
Progressive multif. Leuko	0.05684	0.01195
Reticulosarocoma	-0.01551	-0.00138
Burkitt's Tumor	-0.01222	-0.00242

Appendix Table 1 (Continued)

AIDS Indicators	Factor Loadings	Scoring Coefficients
Deficient cell immunity	0.1438	0.03324
Immune mechanistic Disease	0.17951	0.04625
Autoimmune Disease	0.01421	0.00302
Immunity Deficiency	0.31518	0.08528
Pneumocytosis	0.78004	0.3185
HIV disease	0.52396	0.15537
HTLV-TII/LAV	0.3044	0.08364
HIV disease	0.40821	0.12368
Positive serum of virus col HTLVLA	0.21164	0.05824

Appendix Table 2

Factor Loading and Scoring Coefficients on
Comorbidity Index

Indicators Other Health Conditions	Factor Loadings	Scoring Coefficients
Infectious Disease	0.51559	0.13017
Neoplasm	0.39736	0.08721
Metimmune Disease	0.48544	0.11794
Immune Disorder	0.28804	0.05997
Blood Disease	0.4367	0.10136
Nervous Disorder	0.49236	0.11224
Circulatory Problem	0.53823	0.13736
Respiratory Problem	0.55605	0.14418
Eneumonia	0.37818	0.08215
Digestive Problem	0.53476	0.13232
Genitourinary Problem	0.41461	0.09436
Skin Disease	0.41601	0.09354
Musculoskeletal Problem	0.47664	0.11402
Other Diagnosis	0.59167	0.15687
Injuries	0.46771	0.11231
Drug Dependency	0.12262	0.02913