

Does Access to Health Care Impact Survival Time after Diagnosis of AIDS?

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ABSTRACT

Lack of access to health care is often blamed for poor health outcomes, but this effect is not supported by existing HIV/AIDS literature. The authors examined the association between access to care and survival time after progression to AIDS, using survival analysis methods. This study combined data from two CDC sponsored studies of HIV-infected persons, a cross-sectional interview study and a longitudinal medical record review study. Study subjects included 752 persons who progressed to AIDS before December 31, 1999, and were patients at either of two major HIV care facilities in Detroit, Michigan. Separate statistical models were used to test associations between survival time after meeting the criteria for AIDS and two indicators of access to health care: (1) perceived access to health care and (2) health care utilization patterns. Perceived access was not associated with survival time after AIDS, but patterns of health care utilization were significantly associated with survival time after AIDS (HR = 2.04, $p < 0.001$). Individuals who received a greater proportion of their care in the ER had a worse survival prognosis than those who received more of their health care in an outpatient clinic setting. It is crucial that we provide HIV-infected populations with tools that enable them to access a regular source of health care.

INTRODUCTION

DIFFERENCES IN SURVIVAL TIME of HIV infected persons are often attributed to differences in access to health care.^{1,2} While this explanation is logical and supported for other disease processes, there is little evidence in the literature to support the conclusion that better access to health care improves survival probability in people living with AIDS. Some stud-

ies have shown that perceived access to health care was associated with health-related quality of life measures.^{3,4} It is important to study the factors that give rise to differences in survival time in the United States so that survival can continue to improve. The recent survival gains, which are often associated with newly available antiretroviral drugs, differ significantly among blacks, whites, men and women.^{5,6} If the factors responsible for these

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differences can be determined, they may then be modified.

Drug therapies from the mid-1990s changed the picture of the AIDS epidemic in the United States. The availability of new antiretroviral drugs and highly active antiretroviral therapy (HAART) in the United States since 1996 has led to a significant reduction in HIV-related morbidity and mortality.⁷⁻¹⁰ Incidences of AIDS-defining opportunistic illnesses have significantly decreased with the introduction of these combination therapies.^{5,11} Clearly, access to these medications extends survival time, but antiretrovirals are very expensive. Private insurance providers, health maintenance organizations, and public programs offer assistance with the cost of these drugs. Attempts to target under-represented populations for involvement in clinical trials for new antiretroviral drugs through the Terry Bein Community Programs for Clinical Research on AIDS (CPCRA) have also helped to close the gap in access to HIV-related treatment.¹

In this article, we examine perceived access to health care and utilization of health services and their associations with survival after AIDS, controlling for HAART status. We hypothesized that indicators of access to health care (both perceived access to care and health care utilization) were significantly associated with survival.

METHODS

This study was conducted under the auspices of the Michigan Department of Community Health's HIV/AIDS Surveillance Section, located in Detroit, Michigan. The databases from two surveillance studies were matched: the Adult/Adolescent Spectrum of HIV Disease (ASD) project, and the Supplement to HIV and AIDS Surveillance (SHAS) project. Both ASD and SHAS are ongoing multi-site projects, located throughout the United States. This study examines data from the two Detroit, Michigan sites. These facilities offer inpatient, outpatient, and emergency care for HIV-infected patients, and are the major HIV care providers in Southeastern Michigan. Candi-

dates for inclusion in this project were at least 18 years of age at the time of their SHAS interview, had completed a SHAS interview, and had an ASD record.

ASD is a surveillance study, initiated in 1990.¹² Data from all medical records available at the two Detroit sites were abstracted in 6-month intervals from the time an HIV-infected person presented for care at one of the participating facilities until he/she died or was lost to follow-up. Medical records for any visit to these facilities were included. Information was collected on HIV-related illnesses, other medical conditions, drug therapies, laboratory tests (including CD4 counts), and health care utilization. At one site, all HIV-infected men and women who presented for care were included in ASD. At the other site, all HIV-infected women but only 40% of HIV-infected men were included in ASD, owing to a large number of male patients. Between January, 1990 and December, 1999, approximately 4,600 patients were included and followed as part of the Detroit ASD study.

Initiated in 1990, SHAS is a cross-sectional interview-based surveillance project of persons with HIV or AIDS reported to the state health department.¹³ The SHAS study collected information on demographics, health insurance, socio-economic status, sexual behavior, drug use, reproductive history, and adherence to drug therapies. SHAS candidates were identified as HIV positive at the care facilities and were approached for an interview by a full-time, trained SHAS interviewer. Informed consent was obtained before all interviews. The refusal rate for SHAS was approximately 2%. Between June, 1990 and December, 1999, approximately 2,000 patients were interviewed as part of the Detroit SHAS study.

In Michigan, ASD and SHAS are linked to the HIV/AIDS Reporting System (HARS). HARS is the surveillance registry that contains all reported cases of HIV and AIDS. The ASD/SHAS matched database was created by merging ASD and SHAS based on a numerical identifier that links both studies to HARS. The ASD and SHAS subjects were demographically similar to HIV and AIDS cases in the Detroit metropolitan area (ASD was 72% male, 70%

black, and 65% age 20–40; SHAS was 77% male, 74% black, and 64% age 20–40; HARS in the Detroit metropolitan area was 78% male, 69% black, and 62% age 20–40). Institutional Review Board approval or exemption from review was granted for ASD, SHAS, and the matched database study. The ASD/SHAS matched database included records for 1550 people.

Combination therapy (HAART), which includes three classes of antiretrovirals [nucleoside reverse transcriptase inhibitors (NRTI), protease inhibitors (PI), and non-nucleoside reverse transcriptase inhibitors (NNRTI)], has had a significant impact on survival time in people living with AIDS. In 1996, the FDA approved the first protease inhibitor through its fast track approval process. While protease inhibitors became available in 1996, the United States Public Health Service did not establish treatment guidelines, which recommended triple drug therapy, until 1998.¹⁴ Since specific regimens and dates of antiretroviral usage were not collected in ASD until 1998, we were limited in our ability to categorize HAART. We defined HAART as prescription of at least three antiretroviral drugs in a specified 6-month interval, whether or not these were prescribed simultaneously. For this study, subjects were divided into the following two categories: (1) those who were not prescribed HAART, as defined for this study (the “no HAART” group) and (2) those who have ever been prescribed HAART, as defined for this study (the “HAART” group). Every person in this study fits into one of these two mutually exclusive categories.

The health outcome variable examined was survival time. For the purpose of obtaining a relatively consistent beginning point for each person, survival was measured from the date a person first met the criteria for AIDS to time of death. A consistent AIDS definition was used for all persons to avoid the bias that would result from a sudden increase in the number of AIDS cases in 1993 when the AIDS definition was expanded. For all persons, the 1993 AIDS case surveillance definition¹⁵ was used, which includes laboratory-based criteria (CD4 count <200 or <14%/ μ L of blood) and clinical criteria (AIDS-defining opportunistic

illnesses). For persons in ASD before 1993, the 1993 case definition could still be applied because all necessary data (CD4 count, pulmonary TB, invasive cervical cancer, and recurrent pneumonia) were available since the ASD study began in 1990.

Vital status was collected for the ASD database from the following sources: (1) medical record documentation of death, (2) information from Michigan and Detroit death registries, and (3) report of AIDS-related deaths to the Michigan HARS from other hospitals (those not participating in ASD). Because we made an extensive search of death records, we assumed that any patient not known to have died, or to be lost to follow-up, was alive as of December 31, 1999. Those who were lost to follow-up before December 31, 1999 were censored as of the date of their last visit.

Two separate survival analysis models were used, one that included indicators for perceived access to health care and one that included an indicator for utilization of health care services. The health outcome variable in both models was survival time after AIDS, and race, sex, and mode of transmission were included as predictor variables. Greater than 97% of the subjects reported belonging to either black or white racial groups, therefore other racial and ethnic categories were excluded from these analyses. Age at time of AIDS was included as a continuous variable. The first survival analysis model examined perceived access to health care based on three questions: (1) In the past 12 months, have you ever been denied medical care for HIV infection or AIDS because you could not pay for treatment (yes/no)? (2) In the past 12 months, have you not sought medical care for HIV infection or AIDS because you couldn't pay for it (yes/no)? (3) Do you currently have health care insurance, including government-sponsored insurance such as Medicaid (yes/no)? Responses to these questions from the SHAS interview were used as dichotomous variables for the survival analysis models.

The second survival analysis model focused on health care utilization as measured by the total number of visits to the emergency room (ER) divided by the total number of visits to

both the ER and outpatient clinics. There were no patients in this study who sought care exclusively through the emergency department. This ratio demonstrates the care-seeking behavior of each individual. A person who used the ER as a primary source of health care had a very different care-seeking profile than a person who utilized a regular health care provider and who sought regular outpatient appointments.

We used the Centers for Disease Control and Prevention (CDC) defined mode of transmission categories¹⁶: (1) Men who have sex with men who are also injection drug users (MSM/IDU), (2) men who have sex with men (MSM), (3) injection drug users (IDU), (4) recipients of blood products (transfusion, organ transplant, hemophilia related blood products, etc.), (5) individuals who engage in heterosexual sex, and (6) those with no identified risk (NIR). These categories of risk were applied hierarchically, resulting in mutually exclusive categories.¹⁶ For the purpose of these analyses, MSM/IDU, blood products, and heterosexual sex were combined into one category (referred to as "other"). Preliminary analyses (not shown) demonstrated that these modes of transmission had relatively small sample sizes and were not significantly associated with survival. Dummy variables for IDU, NIR and "other" (compared to MSM) were used for the survival models. MSM was generally used as the referent category for mode of transmission in the literature.¹⁷⁻²¹

Cause of death was not examined, because it was not available for all cases known to have died. However, cause of death was available for 58% of deaths in the ASD database (of which this study was a subset). Of those with a known cause of death, approximately 87% were HIV-related. The number of deaths not due to HIV-related causes were evenly distributed between the treatment groups, suggesting that the probability of death being HIV-related did not change significantly with HAART.

Cox proportional hazard models were used to examine the association between predictor variables and survival time, with ties handled by Efron's method. Only post-SHAS questionnaire survival time was considered, and

survival analysis methods for delayed entry (i.e., left truncation) were employed.²² Log minus log survival curves were plotted against time for each covariate to determine the appropriateness of the proportional hazards assumption.²² Where the proportional hazards assumption was not appropriate, several time-dependent functions were tested to find the model that best fit the data.²³ Interactions between variables in the models were tested and *t*-tests were used to check for collinearity. Data analyses were performed using SAS Software and S-Plus.^{24,25}

RESULTS

Of the 1,550 subjects included in the ASD/SHAS matched database between January, 1990 and December 1999, this study included the 752 people who met the definition for AIDS, and for whom complete data were available for the variables examined. Approximately 35% of subjects had received HAART, 72% were black, 78% were male, and 54% were MSM. Responses to the access to health care questions were distributed as follows: 4.0% were denied medical care because they could not pay, 7.5% did not seek medical care because they could not pay, and 7.5% did not have current health insurance at the time of their SHAS interview. While there was some overlap in responses to these questions (34% were denied care and did not seek care because they could not pay, 16% were denied care because they could not pay and had no health insurance, and 20% had no health insurance and did not seek care because they could not pay), those who were denied medical care were not necessarily the same subjects who did not seek care or did not have health insurance.

For each covariate, log minus log survival plots were examined and confirmed that hazards were proportional for race, sex, mode of transmission, the three indicators of access to care, and the health care utilization variable. However, hazards did not appear to be proportional for HAART. Multiple time-dependent models were tested to determine the best representation of the functional form of

HAART. The time-dependent covariate used was HAART \times survival time.

The methodology for defining HAART was crude, thus we tested the validity of this HAART definition using just the ASD database ($n = 1,709$). We found that HAART was associated with a threefold increase in survival time, which is similar to that described in the literature.⁷⁻¹⁰

Indicators of perceived access to health care and utilization of health care were explored in separate Cox proportional hazards models. The perceived access-based Cox model included race, sex, mode of HIV transmission, HAART, time-dependent HAART, denial of care due to an inability to pay, not seeking care because of an inability to pay, and health insurance status. The utilization-based Cox model included race, sex, mode of HIV transmission, ER visit ratio, HAART, and its corresponding time dependent covariate. For each variable, the estimate and significance were robust to changes in other covariates in the model. Table 1 shows the results from the perceived access model, and Table 2 shows the results of the utilization model.

HAART was a significant predictor of survival in both the access (Table 1) and utilization (Table 2) models, $p < 0.001$. The association between HAART and survival changed over time as illustrated by a significant time-dependent covariate in each model. [Hazard ratios (HR) in the access-based model: HR at 1 year = 0.12, 2 years = 0.14, 5 years = 0.23, 8 years = 0.37. HR in the utilization-based model: HR at 1 year = 0.12, 2 years = 0.14, 5 years = 0.22, 8 years = 0.35.] HAART was consistently associated with improved probability of survival, although this association tended toward the null as survival time increased.

In the first survival analysis model, the perceived access to health care model (Table 1), none of the indicators of access to health care were significantly associated with survival time after AIDS. Additionally, we tested a model in which any one response indicating poor perceived access to care constituted the access variable. This model was also not significant, indicating that the lack of association was not due to inadequate power.

In the second survival analysis model, the

TABLE 1. PERCEIVED ACCESS TO HEALTH CARE^a

Predictor variable	Hazard ratio (HR) (n = 752; 552 deaths)	P-value
Denied care because unable to pay (denied care vs. not denied care)	0.69	0.119
Not sought care because unable to pay (not sought care vs. sought care)	1.10	0.588
Health Insurance (insurance vs. no insurance)	1.01	0.961
HAART (referent = HAART)		<0.001 ^b
Time dependent (HAART \times time)		0.020 ^c
HR at 1 year	0.12	
HR at 2 years	0.14	
HR at 5 years	0.23	
HR at 8 years	0.37	
Race (referent = white)	0.86	0.123
Sex (referent = male)	0.89	0.365
Mode of transmission		
MSM	1.00	Reference
IDU	0.97	0.803
No identified risk	1.00	0.977
Other	0.93	0.606

^aCox proportional hazards model for the relative hazard of death in AIDS patients.

^b $p < 0.0005$.

^c $p < 0.05$.

HAART, highly active antiretroviral therapy; MSM, men who have sex with men; IDU, injection drug users.

utilization of health care model (Table 2), the ratio of ER visits to the total number of ER and outpatient visits was significantly associated with survival time ($p < 0.001$). Also, in this model, white race was significantly associated with increased probability of survival (HR = 0.79, $p = 0.020$).

t-Tests were used to test for colinearity between the perceived access and utilization indicators. Colinearity was detected between the utilization indicator (ER visit ratio) and two of the three indicators of access to health care (not seeking care because of inability to pay and health insurance status). A lower ER visit ratio indicated that a smaller proportion of health care visits occurred in the ER than in the outpatient clinic. The ER visit ratio was lower for those who did not report financial barriers to seeking care than for those who did not seek care because of inability to pay. The mean ER visit ratio was 0.17 [standard deviation (SD) = 0.24] for those who did not avoid seeking health care due to an inability to pay versus 0.27 (SD = 0.31) for those who did avoid seeking health care because they could not pay, and the *t*-test had a p value = 0.019. For those who had health insurance, the ER visit ratio was lower than for those who did not have insurance. The mean ER visit ratio was 0.17 (SD = 0.24) for those with health insurance versus

0.29 (SD = 0.33) for those who did not have health insurance, and the *t*-test p -value = 0.011.

DISCUSSION

In this study we examined the association between survival after AIDS and indicators of perceived access to health care and utilization of health services. We observed that the indicator for utilization of health care and race (in the utilization model only) were significantly associated with survival after AIDS, but that sex, mode of transmission, and perceived access to health care were not significantly associated with survival in the study population. These results affirm the hypothesis posed by other researchers that utilization of health care services was an underlying source of differences in survival previously attributed to race, sex, or mode of transmission.^{1,2}

HAART was a significant predictor of survival in both models. This is consistent with previous studies that found HAART to be associated with decreased morbidity and mortality in HIV-infected populations.⁷⁻¹¹ We also found that the association between HAART and survival decreased over time after AIDS. We attribute this to the long-term non-progressors who were infected prior to the avail-

TABLE 2. UTILIZATION OF HEALTH CARE^a

Predictor variable	Hazard ratio (HR) (n = 752; 552 deaths)	P-value
ER visit ratio (ER visits/total ER + outpatient visits)	2.04	<0.001 ^b
HAART (referent = HAART)		<0.001 ^b
Time dependent (HAART × time)		0.035 ^c
HR at 1 year	0.12	
HR at 2 years	0.14	
HR at 5 years	0.22	
HR at 8 years	0.35	
Race (referent = white)	0.79	0.020 ^c
Sex (referent = male)	0.86	0.262
Mode of transmission		
MSM	1.00	Reference
IDU	0.83	0.201
No identified risk	0.99	0.930
Other	0.89	0.425

^aCox proportional hazards model for the relative hazard of death in AIDS patients.

^b $p < 0.0005$.

^c $p < 0.05$.

HAART, highly active antiretroviral therapy; MSM, men who have sex with men; IDU, injection drug users; ER, emergency room.

ability of HAART and lived without HAART for many years, thus narrowing the gap in survival time between the two treatment groups. This finding is reminiscent of the mortality crossover effect discussed by Wing and colleagues.²⁶ They described mortality ratios that change over time with the force of mortality operating earlier in some populations than in others. Over time, the healthy and resilient of a group remain alive, and the mortality ratio eventually reaches unity.

Individual perception of access to health care was not associated with survival. Perceived access to health care was measured using three indicator questions. The indicators that we used to measure perceived access to health care may have been inadequate. Andersen and colleagues discuss the dimensions of potential and realized access to medical care and several indicators of these dimensions.²⁷ The perceived access indicators that we used fall under the category of potential access and are not complete according to their guide. This may explain the lack of association between perceived access to care and survival that we found. Since all of our study participants have already accessed the health care system, utilization of these services may better predict survival.

Utilization of health care services was measured as the ratio of ER visits to the total number of ER and outpatient visits. Previous studies found that HIV-infected patients had a much better survival probability if they received regular care from providers who specialized in treating HIV infection, compared to providers who did not specialize in HIV care.^{28,29} Our results were consistent with these findings. Individuals who received a greater proportion of their care in the ER had a worse survival prognosis than those who received more outpatient care (which was provided by physicians who specialized in HIV infection).

Perceived access and utilization (ER visit ratio) were not independent indicators of health care access. Those without insurance went to the ER more often, and were less likely to have a regular source of care. Similarly, the group that did not seek medical care due to inability to pay received a greater proportion of their care from the ER. Because of the colinearity that was detected, we expected that both perceived access and uti-

lization would significantly predict survival. Since this was not the case, we conclude that the access to care indicators were inadequate.

There are several limitations of this study. First, the ASD database relies on what was recorded in medical records at the two study sites to completely represent the history of each patient's HIV care. Patients may have been seen for HIV care at additional facilities and that information would not be available. HAART misclassification may have occurred in cases where HAART was prescribed at non-ASD facilities, and not included in the medical records at the ASD facilities.

A second limitation is that SHAS interviews were done only once and at varying times throughout each person's disease process, which may have caused additional bias in the study. However, by limiting SHAS variables to those which should not change over time (e.g., race), or change minimally (e.g., access to health care and utilization of health services) such bias was minimized. Additionally, in the survival analysis models data were left truncated taking into consideration when the SHAS interview occurred. This method adjusts for the bias that would result from not including those who died before they had the opportunity to be interviewed.

A third limitation to the study is that the selection of SHAS participants was not random. However, all eligible participants were approached and the refusal rate was low (2%). Therefore, this should not have a significant impact on study outcomes.

A fourth limitation is the possibility that those with a higher proportion of ER visits were sicker. This would cause them to have worse survival probability. We attempted to minimize the resulting bias by including only individuals who met the criteria for AIDS, thus presuming high levels of morbidity in the entire population.

Populations that are historically underserved by the health care system, such as blacks, women, and injection drug users, are also at high risk for HIV infection. Cunningham and colleagues found that access to medical care was poorer for those with HIV than for other chronic diseases.⁴ Consistent with our findings, other studies have shown that even among in-

dividuals within the health care system, a regular source of health care (including clinic appointments with HIV specialists) increases survival time for people living with AIDS.^{28,29} It is crucial to provide HIV-infected populations with tools that will enable them to adequately access a regular source of health care in a way that will most benefit their health.

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