

BMJ Open Is there lower utilisation of hospice care services during end-of-life care for people living with HIV? A population-based cohort study

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ABSTRACT

Objective Hospice care could improve the quality of life among advanced HIV patients during end-of-life (EOL) treatment. However, providing hospice care services for people living with HIV (PLWH) is challenging due to HIV-related stigma. This nationwide cohort study aims to determine the utilisation of hospice care services among PLWH and HIV-negative individuals during EOL treatment.

Design A retrospective cohort study.

Setting From 2000 to 2018, we identified adult PLWH from the Taiwan centres for disease control HIV Surveillance System. Individuals who had positive HIV-1 western blots were regarded as HIV-infected. Age-matched and sex-matched controls without HIV infection were selected from the Taiwan National Health Insurance Research Database for comparison. All PLWH and controls were followed until death or 31 December 2018.

Participants 32 647 PLWH and 326 470 HIV-negative controls were analysed.

Primary outcome measures Utilisation of hospice care services during the last year of life among PLWH and HIV-negative individuals.

Results A total of 20 413 subjects died during the 3 434 699 person-years of follow-up. Of the deceased patients, 2139 (10.5%) utilised hospice care services during their last year of life, including 328 (5.76%) PLWH and 1811 (12.30%) controls. Adjusting for demographics and comorbidities, PLWH were less likely to receive hospice care services during the last year of life, compared with HIV-negative individuals (adjusted OR: 0.66; 95% CI: 0.57 to 0.75).

Conclusions PLWH had significantly lower utilisation of hospice care services during the last year of life. Our results suggest that future hospice care programmes should particularly target PLWH to increase the optimal utilisation of hospice care services during EOL treatment.

INTRODUCTION

Hospice care has been recommended for patients with life-limiting diseases. Previous studies showed that hospice care was associated with good quality of end-of-life (EOL) treatment among patients with life-limiting

Strengths and limitations of this study

- This study used the Taiwan Centres for Disease Control HIV Surveillance Database to determine the utilisation of hospice care services among people living with HIV during end-of-life treatment.
- HIV-infected cases were defined as those with positive HIV-1 western blot.
- Age-matched and sex-matched controls without HIV infection were selected from the Taiwan National Health Insurance Research Database for comparison.
- Individuals' religion, which may be associated with their decision on receiving hospice care services, was not collected in the National Health Insurance Research Database.

diseases.^{1 2} The WHO estimated that 40 million patients with life-limiting diseases need palliative care.³ However, over 85% of these patients do not receive this care during their EOL treatment.³

The advent of highly active antiretroviral therapy (HAART) has significantly improved the survival among people living with HIV (PLWH).⁴ However, many PLWH in the HAART era still progress to advanced AIDS.⁵ Hospice care among advanced HIV patients could relieve pain and improve their quality of life during EOL treatment.^{6 7} However, providing hospice care services for PLWH is challenging due to HIV-related stigma. A previous survey about attitudes towards hospice care among PLWH reported that hospice services were perceived to provide essential relief from pain and symptoms during the EOL treatment.⁸ However, fear of stigma and concerns regarding the disclosure of their AIDS diagnosis were major barriers for PLWH when participating in hospice care.⁸

Hospice care is associated with improving PLWH's well-being during their EOL treatment and has been recommended for PLWH with a limited life expectancy.⁷ However, studies determining the utilisation of hospice care services among PLWH are limited. A retrospective cohort study involving 367 HIV patients hospitalised in a large urban hospital in the USA found that 28% of PLWH died during that hospitalisation, but only 6% received a palliative care consultation, and 6% were enrolled in hospice.⁹ Another retrospective study using the US Medicare database showed that 24.6% of terminal patients with HIV received hospice care during EOL treatment.¹⁰

Understanding the utilisation of hospice care services in PLWH during EOL treatment could guide the comprehensive HIV care programme. Therefore, this nationwide population-based cohort study aims to determine the utilisation of hospice care services among PLWH and HIV-negative individuals during their EOL treatment from 2000 to 2018.

METHODS

Data source and study patients

This population-based cohort study identified adult PLWH from the Taiwan Centres for Disease Control (CDC) HIV Surveillance System between 2000 and 2018. In Taiwan, hospital institutes are required to report all new HIV cases to the Taiwan CDC within 24 hours of diagnosis. Individuals who had positive HIV-1 western blots or PCR analysis results were regarded as HIV-infected. In Taiwan, HAART has been offered free-of-charge to all HIV-infected individuals since 1997.¹¹

This cohort study linked the Taiwan National Health Insurance Research Database to the Taiwan CDC HIV Surveillance Database. The control group was selected from the Taiwan National Health Insurance Research Database and included those who had never been reported to the Taiwan CDC as HIV-infected cases. The control group was matched for age, sex and date of enrolment (± 7 days). Ten controls were randomly selected for each HIV patient.^{12 13} All HIV patients and controls were followed until death or up to 31 December 2018. The death events among HIV patients and controls were verified using the death certificate database of Taiwan.¹⁴ To compare the utilisation of hospice care services between patients who were HIV-infected and HIV-negative during their last year of life, this study only included deceased PLWH and controls in the analysis.

This study was approved by the Institutional Review Board of Taipei City Hospital (no. TCHIRB-10709107-W). All methods in this study were performed in accordance with relevant guidelines and regulations, and the informed consents for study patients were waived in this report.

Outcome variable

The outcome was the utilisation of hospice care services during the last year of life among PLWH and the control

group. This study used the Taiwan National Health Insurance Research Database to determine the utilisation of hospice care services during the last year of life between the two groups. Hospice care services consisted of hospice inpatient care, hospice home care and hospice-shared care.¹⁵

Main explanatory variable

The main explanatory variable was HIV infection. HIV-infected individuals were defined as those with positive HIV-1 western blot or PCR analysis results.

Control variables

The control variables included sociodemographic characteristics and comorbidities. Sociodemographic factors included age, sex, income level and urbanisation. The income level in study patients was calculated from their average monthly income and grouped into three levels: (1) low-income level, defined as an amount lower than the US\$640 per month (New Taiwan Dollars (NTD) \$19 200); (2) moderate-income level, defined as an amount between the US\$1332 and 640 per month (<40 000 NTD to 19 201) and (3) high-income level, defined as an amount more than the US\$1333 per month (40 000 NTD). Urbanisation was classified as urban, suburban or rural areas.¹⁶ The comorbidities were defined as the presence of an appropriate International Classification of Diseases, Ninth and Tenth Revision, Clinical Modification (ICD-9-CM and ICD-10-CM) code, including cancer, diabetes, chronic kidney disease, congestive heart failure, coronary heart disease, liver cirrhosis, chronic obstructive pulmonary disease, dementia and cerebrovascular disease (online supplemental table 1). The comorbidities in study patients were defined as the condition occurred in an inpatient setting or in three or more outpatient visits.¹⁷

Patient and public involvement

No patient involved in the development of the research question, study design, outcome measures and conduction of the study.

Statistical analysis

Continuous data in study patients were presented as the mean (SD), and a two-sample t-test was used to compare groups. We then analysed categorical data using the Pearson χ^2 test wherever appropriate.

The crude associations of HIV infection and other covariates with the outcome (utilisation of hospice care services during the last year of life) were estimated by computing the ORs and corresponding 95% CIs. We then performed a multivariate logistic regression to assess the association between HIV infection and the utilisation of hospice care services, after adjusting for the sociodemographic factors and comorbidities. Thus, we defined a variable with $p < 0.05$ as a significant factor affecting this association. Adjusted ORs (AOR) with 95% CI indicated the strength and direction of these associations.

Table 1 People living with HIV and matched controls

	No. (%) of patients*		
Characteristics	Patients with HIV, n=32647	Patients without HIV, n=326470	P value
Demographics			
Age, years			
Mean±SD	32.68±10.12	32.68±10.12	1
18–64	32 252 (98.79)	322 520 (98.79)	1
≥65	395 (1.21)	3950 (1.21)	
Sex			
Female	1913 (5.86)	19 130 (5.86)	1
Male	30 734 (94.14)	307 340 (94.14)	
Death			
No	26 956 (82.57)	311 748 (95.49)	<0.001
Yes	5691 (17.43)	14 722 (4.51)	
Total follow-up duration (person-years)	283 112	3 151 587	<0.001

*Unless stated otherwise.

HIV, human immunodeficiency virus.

We conducted subgroup and sensitivity analyses to examine the robustness of the main findings after stratifying patients by age and sex. We performed all data management and analyses using the SAS V.9.4 statistical software package (SAS Institute, Cary, NC, USA).

RESULTS

Patient selection

A total of 32 647 adult HIV-infected individuals were reported to the Taiwan CDC from 2000 to 2018. Another 326 470 age-matched and sex-matched patients without HIV infection were randomly selected for the control group (table 1). During the 3 434 699 person-years of follow-up, 20 413 patients died, including 5691 (17.43%) of the PLWH and 14 722 (4.51%) of the control group.

Characteristics of deceased patients by HIV status

Table 2 shows the characteristics of deceased patients with and without HIV infection. In comparison to with HIV-negative individuals, PLWH were more likely to be younger (39.3 vs 44.7 years) and female. Moreover, PLWH had lower proportion of comorbidities than control group. During the study follow-up period, 2139 patients utilised hospice care services during their last year of life, including 328 (5.76%) PLWH and 1811 (12.30%) HIV-negative individuals.

Factors associated with utilisation of hospice care services during the end-of-life treatment in deceased patients

Table 3 shows the univariate and multivariate analyses of factors associated with the utilisation of hospice care services during the last year of life among deceased patients. After adjusting for the potential confounders, HIV infection was significantly associated with lower utilisation of hospice care services during the last year of

life (AOR: 0.66; 95% CI: 0.57 to 0.75; table 2). Moreover, age ≥65 years and men were associated with a lower utilisation of hospice care service during the last year of life. Factors associated with higher utilisation of hospice care services included intermediate and high-income levels and the comorbidities of cancer and COPD.

Subgroup analysis for the association between HIV infection and utilisation of hospice care services

Table 4 shows the results of subgroup analysis for the association between HIV infection and utilisation of hospice care services after stratifying study patients by age and sex. HIV infection was associated with a lower utilisation of hospice care services during the last year of life among male patients and those aged 15–64.

DISCUSSION

The present study is the largest cohort study on the utilisation of hospice care services among PLWH and HIV-negative individuals during their EOL treatment. The results indicate that PLWH had a significantly lower utilisation of hospice care services during EOL treatment compared with age-matched and sex-matched HIV-negative individuals.

Our study showed robust associations between HIV infection and utilisation of hospice care services after stratifying patients by age and sex. HIV infection is associated with a lower likelihood of receiving hospice care services among male patients and those aged 15–64 years.

Hospice care could improve PLWH's quality of life during their EOL treatment.⁷ However, there are limited studies evaluating the utilisation of hospice care services among PLWH. A retrospective cohort study including 367 HIV patients hospitalised in a large urban safety-net

Table 2 Characteristics of deceased patients by HIV status

Characteristics	No. (%) of subjects*		P value
	Deceased patients with HIV, n=5691	Deceased patients without HIV, n=14 722	
Demographics			
Age, years			
Mean±SD	39.27±12.74	44.73±15.30	<0.001
18–64	5410 (95.06)	12 765 (86.71)	<0.001
≥65	281 (4.94)	1957 (13.29)	
Sex			
Female	433 (7.61)	633 (4.30)	<0.001
Male	5258 (92.39)	14 089 (95.70)	
Income level			
Low	2112 (37.11)	4540 (30.84)	<0.001
Intermediate	2619 (46.02)	6740 (45.78)	
High	960 (16.87)	3442 (23.38)	
Urbanisation			
Rural	491 (8.63)	1601 (10.87)	<0.001
Suburban	3228 (56.72)	9289 (63.10)	
Urban	1972 (34.65)	3832 (26.03)	
Comorbidity			
Cancer	1149 (20.19)	5076 (34.48)	<0.001
Diabetes	881 (15.48)	3857 (26.20)	<0.001
Chronic kidney disease	754 (13.25)	2814 (19.11)	<0.001
Congestive heart failure	381 (6.69)	1822 (12.38)	<0.001
Coronary heart disease	691 (12.14)	3132 (21.27)	<0.001
Liver cirrhosis	751 (13.20)	2652 (18.01)	<0.001
COPD	1212 (21.30)	3546 (24.09)	<0.001
Dementia	65 (1.14)	546 (3.71)	<0.001
Cerebrovascular disease	678 (11.91)	3114 (21.15)	<0.001
Utilisation of hospice care services during the last year of life	328 (5.76)	1811 (12.30)	<0.001

*Unless stated otherwise.

COPD, chronic obstructive pulmonary disease.

hospital showed that 28% of the patients died during such hospitalisation. However, only 6% of the patients were enrolled in hospice.⁹ Another retrospective study involving 1375 HIV patients in the US found that 24.6% of terminal Medicare patients with HIV received hospice care during EOL treatment.¹⁰ Our study followed up 32 647 HIV patients and found that 5.76% of PLWH received hospice care services during their EOL treatment. While comparing with HIV-negative individuals, PLWH had a significantly lower utilisation of hospice care services during the last year of life. The findings of our study suggest that hospice care is underutilised among PLWH and it is imperative to increase optimal hospice care services among PLWH during EOL treatment.

This study showed that PLWH had a 34% lower likelihood of receiving hospice care services during EOL treatment as compared with HIV-negative individuals. HIV-related stigma and professionals' lack of experience

in treating advanced HIV may explain for the lower utilisation of hospice care services in PLWH towards the EOL. HIV-related stigma remains prevalent in society,¹⁸ which would cause the PLWH's unwillingness to disclose their HIV status. Since the process of participating in hospice care services involves a discussion regarding EOL treatment's preferences among PLWH, patients' family and healthcare providers,¹⁹ HIV-related stigma and PLWH's disclosure concern of their HIV status would lead to the lower likelihood of them agreeing with having an EOL discussion with physicians. A qualitative study in Uganda showed that HIV patients' fear of such a stigma and their concern regarding the disclosure of their AIDS diagnosis were the major hurdles when participating in hospice care.⁸ Since hospice care is associated with the relief of pain and good quality of care among patients nearing death,^{6 7} it is imperative to provide hospice care services for PLWH during EOL treatment.

Table 3 Univariate and multivariate analysis of factors associated with utilisation of hospice care services during the last year of life among deceased patients

Variables	Number of patients	Utilisation of hospice care services†	Univariate	Multivariate analysis
		N (%)	OR (95% CI)	AOR (95% CI)
HIV infection				
No	14 722	1811 (12.30)	1	1
Yes	5691	328 (5.76)	0.44 (0.39 to 0.49)***	0.66 (0.57 to 0.75)***
Demographics				
Age, years				
18–64	18 175	1921 (10.57)	1	1
≥65	2238	218 (9.74)	0.91 (0.79 to 1.06)	0.59 (0.49 to 0.70)***
Sex				
Female	1066	150 (14.07)	1	1
Male	19347	1989 (10.28)	0.70 (0.59 to 0.84)***	0.66 (0.54 to 0.81)***
Income level				
Low	6652	359 (5.40)	1	1
Intermediate	9359	1086 (11.60)	2.30 (2.03 to 2.60)***	1.96 (1.72 to 2.25)***
High	4402	694 (15.77)	3.28 (2.87 to 3.75)***	2.21 (1.90 to 2.57)***
Urbanisation				
Rural	2092	209 (9.99)	1	1
Suburban	12517	1305 (10.43)	1.05 (0.90 to 1.22)	0.97 (0.82 to 1.16)
Urban	5804	625 (10.77)	1.09 (0.92 to 1.28)	0.95 (0.79 to 1.15)
Comorbidity				
Cancer	6225	1905 (30.60)	26.30 (22.86 to 30.25)***	24.48 (21.23 to 28.24)***
Diabetes	4738	551 (11.63)	1.17 (1.05 to 1.29)**	1.05 (0.93 to 1.19)
Chronic kidney disease	3568	401 (11.24)	1.10 (0.98 to 1.24)	0.97 (0.84 to 1.11)
Congestive heart failure	2203	192 (8.72)	0.80 (0.68 to 0.93)**	0.99 (0.81 to 1.20)
Coronary heart disease	3823	438 (11.46)	1.13 (1.01 to 1.27)*	1.02 (0.89 to 1.18)
Liver cirrhosis	3403	491 (14.43)	1.57 (1.41 to 1.75)***	0.97 (0.86 to 1.10)
COPD	4758	606 (12.74)	1.35 (1.22 to 1.49)***	1.15 (1.02 to 1.29)*
Dementia	611	49 (8.02)	0.74 (0.55 to 0.99)*	0.92 (0.65 to 1.30)
Cerebrovascular disease	3792	329 (8.68)	0.78 (0.69 to 0.88)***	0.87 (0.75 to 1.00)

*P<0.05; **p<0.01; ***p<0.001.

†During the last year of life.

AOR, adjusted OR; COPD, chronic obstructive pulmonary disease.

Table 4 Sensitivity analysis for the associations between HIV infection and utilisation of hospice care services after adjusting for patient characteristics

Study subgroups	Utilisation of hospice care services	
	AOR (95% CI)*	P value
All patients (n=20 413)	0.66 (0.57 to 0.75)	<0.001
Aged 15–64 (n=18 175)	0.66 (0.57 to 0.76)	<0.001
Aged ≥65 (n=2238)	0.74 (0.43 to 1.26)	0.271
Male patients (n=19 347)	0.66 (0.57 to 0.76)	<0.001
Female patients (n=1066)	0.80 (0.48 to 1.31)	0.372

*During the last year of life.

AOR, adjusted OR.

Professionals' lack of experience in treating advanced HIV patients needing palliative care may also explain for the lower utilisation of hospice care services among PLWH towards the EOL. The provision of hospice care services among PLWH is complex, which looks into whether the patients should continue treatment with antiretroviral drugs and whether the patients should request the concealment of their HIV status from their families. Although there are no guidelines in informing clinicians on when to stop HAART among advanced HIV patients enrolling in hospice care, the side effects and pill burden of antiretroviral drugs may decrease the PLWH's quality of life during EOL treatment.²⁰ The decision to discontinue antiretroviral therapy for advanced HIV patients receiving hospice care should be considered through a comprehensive discussion with patients and

their families. Healthcare providers may not be familiar with these issues regarding the timing to discontinue HAART and concealment of HIV infection from their families among PLWH needing hospice care. As such, this would cause the professionals' lower likelihood of providing hospice care services for advanced HIV patients. A previous nationwide hospital survey in Japan showed that 11.2% of healthcare providers at palliative care units were not willing to provide EOL care for PLWH due to lack of knowledge and experience in treating advanced HIV patients nearing death.²¹ Since hospice and palliative care services are associated with improvements in quality of life among patients towards the EOL,⁷ it is important to provide hospice care service for PLWH during EOL treatment.

This nationwide cohort study has several strengths. First, this study is the largest cohort study to compare the utilisation of hospice care services in PLWH and HIV-negative individuals during EOL care. Our research design included strict HIV diagnostic criteria, which improves the validity of the main findings. Moreover, this nationwide cohort study followed up all PLWH and controls with referral bias being minimised because all medical care is covered by the Taiwan National Health Insurance. Furthermore, the study's large sample size was sufficiently powered to detect the real, even subtle, difference between PLWH and controls.

The study nevertheless has two limitations. First, individuals' religion that may be associated with their decision on receiving hospice care services was not collected in the National Health Insurance Research Database. Second, since almost all our patients were Taiwanese, the external validity of our findings may be a concern. Therefore, future studies are needed to verify our results in other non-Asian ethnic groups.

CONCLUSION

This population-based cohort study showed that only 5.76% of PLWH received hospice care services during EOL treatment. Compared with HIV-negative individuals, PLWH had a significantly lower utilisation of hospice care services during EOL treatment. As hospice care service could relieve pain and improve patients' spiritual well-being during EOL care, future hospice care programmes should particularly target PLWH to increase the optimal utilisation of hospice care services during EOL treatment.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This study was approved by the Institutional Review Board of Taipei City Hospital (no. TCHRB-10709107-W) and all methods were performed in accordance with relevant guidelines and regulations.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data analysis was guided by the monitoring regulation guidelines of Scientific Data Center of the Minister of Health and Welfare, Taiwan. All the data are open for accessing following the approved security protocols with specific processes.

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REFERENCES

- 1 Temel JS, Greer JA, Muzikansky A, *et al*. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med* 2010;363:733-42.
- 2 Higginson IJ, Evans CJ. What is the evidence that palliative care teams improve outcomes for cancer patients and their families? *Cancer J* 2010;16:423-35.

- 3 WHO. Palliative Care—Key facts, 2020. Available: <https://www.who.int/news-room/fact-sheets/detail/palliative-care> [Accessed 25 Jul 2021].
- 4 Cihlar T, Fordyce M. Current status and prospects of HIV treatment. *Curr Opin Virol* 2016;18:50–6.
- 5 Smith CJ, Ryom L, Weber R, *et al.* Trends in underlying causes of death in people with HIV from 1999 to 2011 (D:A:D): a multicohort collaboration. *Lancet* 2014;384:241–8.
- 6 Currow DC, Agar MR, Phillips JL. Role of hospice care at the end of life for people with cancer. *J Clin Oncol* 2020;38:937–43.
- 7 Goodkin K, Kompella S, Kendell SF. End-Of-Life care and bereavement issues in human immunodeficiency Virus-AIDS. *Nurs Clin North Am* 2018;53:123–35.
- 8 Too W, Watson M, Harding R, *et al.* Living with AIDS in Uganda: a qualitative study of patients' and families' experiences following referral to hospice. *BMC Palliat Care* 2015;14:67.
- 9 Rhodes RL, Nazir F, Lopez S, *et al.* Use and predictors of end-of-life care among HIV patients in a safety net health system. *J Pain Symptom Manage* 2016;51:120–5.
- 10 Leibowitz AA, Tan D, Gildner JL. The effect of hospice on end-of-life costs for terminal Medicare patients with HIV. *Inquiry* 2020;57:46958020969381.
- 11 Chen Y-MA, Kuo SH-S. Hiv-1 in Taiwan. *The Lancet* 2007;369:623–5.
- 12 Wacholder S, McLaughlin JK, Silverman DT, *et al.* Selection of controls in case-control studies. I. principles. *Am J Epidemiol* 1992;135:1019–28.
- 13 Beaumont JJ, Steenland K, Minton A, *et al.* A computer program for incidence density sampling of controls in case-control studies nested within occupational cohort studies. *Am J Epidemiol* 1989;129:212–9.
- 14 Department of Health. *Vital statistics in Taiwan*. Taiwan: Department of Health, Executive Yuan, 1971.
- 15 Shih T-C, Chang H-T, Lin M-H, *et al.* Trends of do-not-resuscitate orders, hospice care utilization, and late referral to hospice care among cancer decedents in a tertiary hospital in Taiwan between 2008 and 2014: a hospital-based observational study. *J Palliat Med* 2017;20:838–44.
- 16 Liu CY, Hung YT, Chuang YL. Incorporating development stratification of Taiwan townships into sampling design of large scale health interview survey. *J Health Manage* 2006;4:1–22.
- 17 Yen Y-F, Chung M-S, Hu H-Y, *et al.* Association of pulmonary tuberculosis and ethambutol with incident depressive disorder: a nationwide, population-based cohort study. *J Clin Psychiatry* 2015;76:e505–11.
- 18 Rueda S, Mitra S, Chen S, *et al.* Examining the associations between HIV-related stigma and health outcomes in people living with HIV/AIDS: a series of meta-analyses. *BMJ Open* 2016;6:e011453.
- 19 Myers J. Improving the quality of end-of-life discussions. *Curr Opin Support Palliat Care* 2015;9:72–6.
- 20 Chen W-T, Shiu C-S, Yang JP, *et al.* Antiretroviral therapy (art) side effect impacted on quality of life, and depressive symptomatology: a Mixed-Method study. *J AIDS Clin Res* 2013;4:218.
- 21 Kojima Y, Iwasaki N, Yanaga Y, *et al.* End-Of-Life care for HIV-infected patients with malignancies: a questionnaire-based survey. *Palliat Med* 2016;30:869–76.

Supplementary table 1 ICD-9-CM and ICD-10-CM codes for comorbidities		
Comorbidities	ICD-9-CM code	ICD-10-CM code
Cancer	140~208	C, D0
Diabetes	250	E08~E13
Chronic kidney disease	585, 586	N18
Congestive heart failure	428, 398.91, 402.01, 402.11,	I50, I0981, I110, I130, I132
	402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93	
Coronary heart disease	410~414	I20~I25
Liver cirrhosis	571, 571.2, 571.5, 571.6	K703, K717, K746
Chronic obstructive pulmonary disease	491, 492, 518.1, 518.2, 770.2	J41~J44
Dementia	290	F01~F03
Cerebrovascular disease	430~437	G46.3, G46.4, I60~I66, I69
Opportunistic infections		
Cytomegalovirus disease	(078.5	B25
Tuberculosis	010~018	A15~A19
Disseminated		
Mycobacterium avium complex infection	31.2	A31.2

Pneumocystis jirovecii pneumonia (or pneumocystis carinni pneumonia)	136.3	B59
Cryptococcal meningitis	(321.0	B45.1
Candidiasis	112	B37
Penicillium marneffeii infection	117.9	B48.3, B48.8, B49
Herpes zoster	((053)	B02
AIDS-related cancer		
Kaposi sarcoma	176	C46
Non-Hodgkin lymphoma	202.8	C85.8, C85.9
Cervix	180	C53.9

ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification; AIDS, acquired immune deficiency syndrome.