

# Chapter VI

## Causes of Death

### *Key Words:*

Death rates  
Diabetic ESRD  
Cardiac deaths  
Infection in ESRD  
AIDS

Malignancy in dialysis  
Hemodialysis  
Peritoneal dialysis  
Transplant  
Withdrawal from dialysis

Over 100,000 ESRD patients died in the United States between 1993 and 1995. This chapter focuses on the specific causes of their high mortality and may serve as a source to help lower the death rates of ESRD patients through further in-depth epidemiological and clinical research. The death rates for specific causes of death for various subgroups of prevalent dialysis and transplant patients are described. In particular, this chapter emphasizes outcomes of diabetic versus nondiabetic patients.

### **Analytical Methods**

The HCFA ESRD Death Notification Form serves as the primary source of information on causes of death among the ESRD population. A revised form has been in use since 1990, which includes 59 cause of death categories (including categories for “other known” and “unknown” cause). This differs from the prior form which listed 22 causes of death. In addition, on the previous form “withdrawal from dialysis” was listed as one of the 22 causes, whereas the new form inquires whether “withdrawal from dialysis” occurred prior to death, as a question separate from “cause of death”. Thus for each death, the patient’s physician reports both the cause of death and whether the patient withdrew from dialysis prior to death. In this chapter, the USRDS reports on data for deaths in 1993-1995. Data for 1993 are Medicare-only patients. Since 1994, non-Medicare patients are also included in the analyses.

The USRDS files include a “missing” cause of death category for those patients who, by means of the Social Security Death Benefits files and hospital discharge records, are known to have died but for whom no Death Notification Form was received. Analyses of these sources reveals that the Death Notification Form was missing or incomplete in about 11 percent of total reported deaths. For completeness, the death rates for patients with missing cause are also shown as a category in all tables. For the purpose of this report, the 59 causes on the HCFA Death Notification Form plus the “missing” category, were collapsed into 14 cause of death categories as shown in Table VI-1. More detailed information is provided in the Reference Tables, section D where the death categories are collapsed to 22 causes. This chapter presents statistics for adult ESRD patients (ages 20 years and over). Causes of death for pediatric patients are described in Chapter VIII.

Death rates were analyzed by primary cause of death among patients who were prevalent at the beginning of, or incident (defined as 90 days following start of ESRD) during, the years 1993, 1994 and 1995. Patients were followed through each year and the days at risk were calculated for each patient by year, so that patients dying during a year contribute only the days from January 1 (if prevalent) or day of ESRD (if incident) to date of death. On this basis, statistics for patient years at risk were calculated. A patient prevalent at the beginning of 1993, 1994, and 1995 contributed data to all three years. In all analyses, patients were censored at loss to followup or end of the calendar year, and in

**Collapsed Categories from Causes of Death on Death Notification Form (HCFA-2746)\***

<p><b><u>Acute Myocardial Infarction (Acute MI)</u></b></p> <p><b><u>Cardiac Arrest, cause unknown</u></b></p> <p><b><u>Cardiac, other</u></b>          Atherosclerotic heart disease          Cardiac arrhythmia          Cardiomyopathy          Pericarditis, including cardiac tamponade          Pulmonary edema, due to exogenous fluid          Valvular heart disease</p> <p><b><u>Cerebrovascular (CVD)</u></b>          Cerebrovascular accident          Ischemic brain damage</p> <p><b><u>Septicemia</u></b>          Septicemia, due to vascular access          Septicemia, due to peritonitis          Septicemia, due to PVD/gangrene          Septicemia, other</p> <p><b><u>Other Infection</u></b>          Pulmonary infection, bacterial          Pulmonary infection, fungal          Pulmonary infection, other          Viral infection, CMV          Viral infection, other          Tuberculosis          Fungal peritonitis          Infection, other          Hepatitis B          Other viral hepatitis</p> <p><b><u>AIDS</u></b></p> <p><b><u>Malignancy</u></b>          Malignant disease, Hx of immunosupp. Rx          Malignant disease, other</p>	<p><b><u>Hemorrhage</u></b>          GI hemorrhage          Hemorrhage from transplant site          Hemorrhage from vascular access          Hemorrhage from dialysis circuit          Hemorrhage from ruptured vascular access          Hemorrhage from surgery          Other hemorrhage</p> <p><b><u>Cachexia</u></b></p> <p><b><u>Hyperkalemia</u></b></p> <p><b><u>Other</u></b>          Pulmonary embolus          Mesenteric infarction/Ischemic bowel          Liver-drug toxicity          Cirrhosis          Polycystic liver disease          Liver failure, cause unknown          Pancreatitis          Perforation of peptic ulcer          Perforation of bowel          Bone marrow depression          Dementia          Seizures          Diabetic coma, hypo/hyperglycemia          Chronic obstructive pulmonary disease          Complications of surgery          Air embolism          Accident related to treatment          Accident unrelated to treatment          Suicide          Drug overdose-street drugs          Drug overdose          Other identified cause</p> <p><b><u>Unknown</u></b></p> <p><b><u>Missing</u></b> (Cause of death not recorded or no Death Notification Form)</p>
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\* Revised, in use since September 1990

**USRDS 1997**

**Table VI-1**

analyses of dialysis groups, patients were censored at transplantation. Patient followup was characterized by age (20-44, 45-64, 65+), race (Black, White), sex, and modality (PD, never transplanted; HD, never transplanted; functioning transplant; PD, failed transplant; HD, failed transplant;) at the beginning of each cohort year for prevalent patients or at 90 days of ESRD for incident patients, better reflecting the effect of modality, which may change in a given patient from one year to the next. The total number of patient deaths by cause and years at risk for each year were aggregated to enhance the stability of the estimated death rates.

Cause-specific death rates for various patient subgroups presented in this chapter were statistically adjusted for demographic covariates (age, race, sex, diabetes, and as indicated, for modality) using direct standardization. Adjustments for age were by 5-year age categories. Patients less than 20 years of age were excluded. Stratified unadjusted death rates for a variety of subgroups are presented in the Reference Tables, Section D. Adjusted and unadjusted death rates due to different causes of death (columns) can be added within a given patient subgroup. The same applies to the Reference Tables and for the tables presented in this chapter.

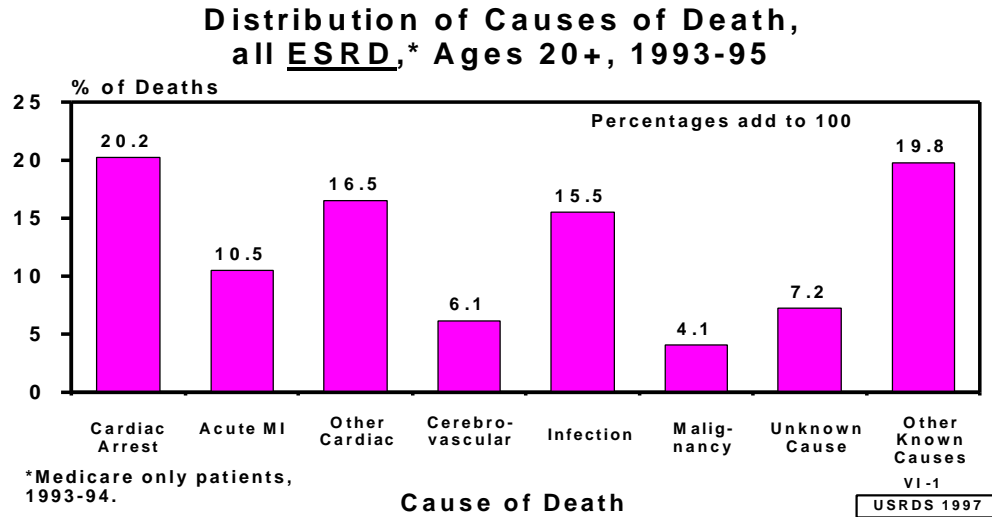


Figure VI-1

The categories are collapsed from the Death Notification Form as per Table VI-1. Infection includes septicemia, other infection, and AIDS. Other cardiac includes pericarditis, atherosclerotic heart disease, cardiomyopathy, cardiac arrhythmia, pulmonary edema, and valvular heart disease. Other known cause includes hemorrhage, cachexia, hyperkalemia, and Other. Missing cause of death is excluded. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only, 1993-94. Source: Reference Table D.4, Special Analysis.

Although death rates tend to be more informative, it is also of interest to analyze the distribution of causes of death among patients who died. This also allows comparisons with other studies and data from other registries which present the percent distribution of cause of death. Percentages can be calculated for various subgroups from death rates in the reference tables and from the “total” columns of Tables VI-2 to VI-6 by dividing the cause-specific death rate by the overall reported death rate (total death rate minus the missing as the denominator). For example, from Table VI-2, acute MI in the total column is 16.5 per 1000 patient years. As a percent, it is  $16.5 / (179.3 - 22.6)$ , or 10.5 percent of all reported deaths. Similarly, for patient subgroups listed in the same tables, dividing an adjusted death rate by the corresponding total reported death rate (minus that for missing) would result in the percent of deaths by subgroup.

### Causes of Death Among ESRD Patients

The distribution of causes of death for all ESRD patients aged 20 years and older is shown in Figure VI-1. Cardiac causes (cardiac arrest, acute myocardial infarction, and other cardiac) account for almost half of the reported causes of adult ESRD patient deaths. Infection, cerebrovascular disease,

and malignancy account for 15.5 percent, 6.1 percent, and 4.1 percent of adult ESRD causes of death, respectively. Septicemia makes up more than 75 percent of the infection category. Other known causes account for almost 20 percent of deaths. Mesenteric infarction/ischemic bowel and dementia are the largest causes in this category (1-2 percent each). The cause of death is reported unknown for 7.2 percent of adult ESRD patient deaths.

Table VI-2 shows death rates among all prevalent and incident ESRD patients (dialysis transplant) by cause of death for sex, race, age (20-64 years and greater than 65 years), and cause of ESRD (diabetes versus all others) subgroups, adjusted for all other covariates. Cardiac arrest (potentially including some deaths of unknown cause), acute myocardial infarction, and all other cardiac causes have adjusted death rates of 31.6, 16.5, and 27.6 deaths per 1000 patient years, respectively. As expected, death rates due to these cardiac causes are greater for diabetic than nondiabetic patients. Death rates due to these cardiac causes are substantially higher among patients 65 and older than among the patients in the younger age group. They are also higher among White than Black and among male than female ESRD patients. The overall death rate due to cerebrovascular disease was 9.6 deaths per 1000 patient years. The death rates due to this cause was more than two fold higher

**Adjusted<sup>1</sup> Cause Specific Death Rates for All ESRD Patients  
By Sex, Race, Age (20-64,65+), and Diabetic Status, 1993-1995**

Cause of Death <sup>2</sup>	Deaths per 1000 Dialysis Patient Years <sup>4</sup>								
	Total	Male	Female	Black	White	Age 20-64	Age 65+	Diab	Non-Diab
Acute MI	16.5	18.1	14.7	13.0	18.7	11.5	24.6	23.0	13.4
Cardiac Arrest	31.6	32.4	30.9	30.1	33.1	21.1	47.9	43.8	26.2
Other Cardiac <sup>3</sup>	27.6	30.3	24.6	18.9	32.4	16.1	44.0	35.1	24.2
Cerebrovascular Dis.	9.6	8.2	11.2	9.2	9.9	6.5	14.6	13.4	7.9
Septicemia	17.3	15.9	18.9	17.8	17.8	12.7	25.2	23.8	14.1
AIDS	1.7	2.3	0.8	3.1	0.3	2.4	0.2	0.4	2.0
Other Infection	5.3	5.8	4.9	4.3	5.8	3.3	8.0	5.9	5.0
Malignancy	6.3	7.4	5.2	6.0	6.9	4.1	11.1	4.2	7.5
Hemorrhage	3.2	3.2	3.1	3.1	3.3	2.2	4.7	2.9	3.4
Hyperkalemia	3.4	3.2	3.5	2.0	4.2	2.5	4.4	4.7	2.8
Cachexia	1.8	1.6	2.0	1.4	2.0	0.8	3.1	2.0	1.7
Other	21.1	20.2	22.0	16.2	24.5	13.8	32.0	24.6	19.8
Unknown	11.3	11.5	11.2	11.8	11.4	7.9	16.7	15.5	9.4
Missing	22.6	23.8	21.2	19.5	24.9	14.8	41.6	29.8	19.9
TOTAL <sup>5</sup>	179.3	184.1	174.3	156.2	195.2	119.7	278.0	229.0	157.3

Medicare only patients, 1993-94. Source: Special Analysis

<sup>1</sup> Adjusted for sex, race, age (5-year categories) and diabetic status, excludes ages <20.

<sup>2</sup> Categories collapsed from Death Notification Form (HCFA-2746) as per Table VI-1

<sup>3</sup> Other cardiac includes pericarditis, atherosclerotic heart disease, cardiomyopathy, cardiac arrhythmia, pulmonary edema, and valvular heart disease.

<sup>4</sup> Death Rates add vertically to the total.

<sup>5</sup> This category is unadjusted

USRDS 1997

Table VI-2

in the older age group, were almost twice as high among diabetics than nondiabetics, somewhat higher among females than males, and similar for Black and White patients.

If one assumes that virtually all cardiac deaths are due to atherosclerotic disease, then the combination of acute myocardial infarction, cardiac arrest, other cardiac, and cerebrovascular accident gives an estimate of the contribution of atherosclerotic disease to all deaths in ESRD patients. This sum accounts for a death rate of 85.3 per 1000 patient years overall (54 percent of all deaths) and a death rate as high as 131.1 per 1000 years among the over 65-year age group (55 percent of all deaths in this age category). These may be underestimates, since some of the infection deaths may in fact be due to gangrene in patients with peripheral vascular disease. Cardiac causes are discussed in more detail below.

The overall death rate due to septicemia was 17.3 per 1000 patient years. The death rate due to other infections (excluding AIDS) was 5.3. Combined, these infectious causes had a higher death rate than acute myocardial infarction among the overall populations and for all race, sex, and age subgroups shown. ESRD patients are known to have a high incidence of infection due to defects in cellular immunity, neutrophil function, and complement activation (Khan 1993; Vanholder 1993).

Additionally, dialysis patients have an elevated risk of infection due to the vascular or peritoneal access. Although death rates due to septicemia were higher for females than males, the death rate due to other infections was higher among males and diabetics. Adjusted death rates due to septicemia were similar among Blacks and Whites, whereas death rates due to other infections were higher among Whites. Death rates due to any infectious etiology were approximately twice as high among patients age 65-years and older compared to the younger category. AIDS accounted for one percent of deaths overall. Adjusted death rates due to AIDS were almost three times higher for males than females, more than 10 times higher among Blacks than Whites, and approximately 12 times higher among patients aged 20-64 years compared to those over age 65 years, which seems to reflect the risk of acquiring AIDS. Infectious causes are discussed in more detail below.

Death rates due to malignancy (6.3 deaths per 1000 patient years) indicate that malignancy is not a common cause of death. Previous studies have suggested an increased risk of certain malignancies in the dialysis (Port, 1989a; Kantor 1987; Inamoto 1991) and transplant (Penn 1988) populations compared to the general population. Although this may be due to the effect of uremia or a side-effect of dialytic or immunosuppressive therapy, the recent USRDS Case Mix studies found a diagnosis of

**Adjusted<sup>1</sup> Death Rates and Percent Distribution of Specific Cardiac Causes, Among All Cardiac Deaths for All Dialysis Patients, 1993-95**

Cause of Death	Total DR	Hemo DR	PD DR	% of Cardiac	% of Total
Cardiac arrest, cause unknown	44.4	44.1	50.8	41.8	18.2
Acute myocardial infarction	22.8	22.2	27.5	21.5	9.4
Cardiac arrhythmia	14.1	14.0	15.0	13.3	5.8
Cardiomyopathy	10.5	9.8	16.4	9.9	4.3
Atherosclerotic heart disease	10.1	9.5	14.9	9.5	4.1
Valvular heart disease	1.6	1.6	2.0	1.5	0.7
Pericarditis	0.3	0.3	0.4	0.3	0.1
Pulmonary edema	2.3	2.4	2.5	2.1	0.9
<b>Total Cardiac Causes</b>	<b>106.1</b>	<b>103.8</b>	<b>129.4</b>	100.0	43.6
<b>Overall Total</b>	<b>243.4</b>	<b>238.7</b>	<b>295.1</b>		

Medicare only patients, 1993-94. Source: Special Analysis

DR=Death rate per 1000 patient years.

USRDS 1997

<sup>1</sup> Adjusted for age (5 yr categories), race, sex, and diabetic status, excludes ages <20.

**Table VI-3**

malignancy in 9 percent of patients at initiation of therapy (USRDS 1992), suggesting that acceptance of patients with malignancy is relatively common. Death rates due to this cause are almost three times higher among ages 65 and older compared to ages 20-64 years. Diabetics have a much lower death rate due to malignancy than nondiabetics which may reflect a competing risk given the high probability of diabetics dying of other causes.

heart disease, pericarditis, and pulmonary edema account for less than four percent of cardiac causes of death combined. PD patients show a 25 percent higher rate of death due to cardiac causes compared to HD patients. The death rate due to cardiac arrest, acute myocardial infarction, and cardiomyopathy is higher for PD patients than HD patients and similar for all other cardiac causes. The high prevalence of cardiac disorders in ESRD patients has been noted previously and has been shown to be associated with an elevated risk of mortality (USRDS 1992; Churchill 1992; Foley 1995).

**Causes of Death Among Dialysis Patients**

Death rates by cause of death were analyzed for prevalent and incident ESRD patients treated with hemodialysis (HD) or peritoneal dialysis (PD) who had never received a transplant. Patients with a history of prior transplant and the small fraction receiving “unknown” type of dialysis were excluded. Patients transplanted during the year of observation were censored (removed from the analysis) on day of transplantation.

The distribution of specific infectious causes among all deaths classified as infection are shown in Table VI-4 for all adult dialysis patients. Septicemia has the largest proportion (71.9 percent) of deaths due to infectious causes followed by pulmonary infection (16.7 percent) and AIDS (7 percent). Death rates due to septicemia are much higher in PD patients than HD patients and similar for all other types of infection. The higher infection deaths among PD patients may be related to several factors including: poor technique, peritoneal access, less overall clearance of small uremic toxins, possible deleterious effects of the PD fluid on macrophage function, malnutrition, or differences in baseline comorbidity between HD and PD patients (Bloembergen, 1996). The higher death rate due to AIDS for PD may reflect greater utilization of PD among AIDS patients developing ESRD.

A USRDS study of new and established dialysis patients, pointed out that cardiac disorders were already present at the time a patient began dialysis (Bloembergen, 1997). The distribution of specific cardiac causes among all deaths classified as cardiac for all dialysis patients ages 20 years and older are shown in Table VI-3. Cardiac arrest ( which may include some deaths with cause unknown), has the largest proportion (41.8 percent) of deaths due to cardiac causes followed by acute myocardial infarction (21.5 percent) cardiac arrhythmia (13.3 percent), cardiomyopathy (9.9 percent), and atherosclerotic heart disease (9.5 percent). Valvular

Table VI-5 shows the death rates for all causes of death for adult dialysis patients. These death rates are adjusted for age, race, sex, modality, and diabetic status. Overall, patterns of cause of death for dialysis patients are similar to those described above for all

**Adjusted<sup>1</sup> Death Rates and Percent Distribution of Specific Infection Causes, Among All Infection Deaths for All Dialysis Patients, 1993-95**

Cause of Death	Total DR	Hemo DR	PD DR	% of Infection	% of Total
Septicemia	23.9	22.4	36.2	71.9	9.8
Pulmonary Infection	5.6	5.6	6.1	16.7	2.3
Viral Infection	0.3	0.3	0.2	0.8	0.1
AIDS	2.3	2.3	2.9	7.0	1.0
Other Infection	1.2	1.0	2.4	3.5	0.5
<b>Total Infection Causes</b>	<b>33.2</b>	<b>31.6</b>	<b>47.8</b>	100.0	13.6
<b>Overall Total</b>	<b>243.4</b>	<b>238.7</b>	<b>295.1</b>		

Medicare only patients, 1993-94. Source: Special Analysis  
 DR=Death rate per 1000 patient years.

USRDS 1997

<sup>1</sup> Adjusted for age (5 yr categories), race, sex, and diabetic status, excludes ages <20.

**Table VI-4**

ESRD (Table VI-2). However, death rates due to all causes of death are higher for dialysis patients than for the general ESRD population because the transplant population, which is generally younger and healthier and which has lower death rates, is included in the total ESRD category.

The death rate due to malignancy is higher for hemodialysis than peritoneal dialysis, also consistent with the prior published study (Port, 1989a; Kantor 1987; Inamoto 1991). This analysis also reveals that

the death rate due to hyperkalemia is higher among hemodialysis patients. These differences in cause-specific mortality among PD and HD treated patients may be due to the technical differences of these dialysis modalities, differences in compliance, medical care, or dose of dialysis. As a result of a number of studies showing a relationship between dose of dialysis and mortality, dose of dialysis has increased substantially on a national level among the hemodialysis population (see Chapters III and IV). However, only recently has a similar relationship

**Adjusted<sup>1</sup> Cause Specific Death Rates for Never Transplanted Dialysis Patients<sup>2</sup> By Treatment Modality, Age, Sex, Race and Diabetic status, 1993-95**

Cause of Death <sup>3</sup>	Total	Deaths Per 1000 Patient Years <sup>4</sup>									
		HD	PD	Male	Female	Black	White	20-64	65+	Diab	Nondiab
Acute MI	22.8	22.2	27.5	24.9	20.4	17.6	26.1	15.7	31.1	30.0	18.8
Cardiac Arrest	44.4	44.1	50.8	45.6	43.3	42.0	46.7	29.4	62.3	59.0	37.0
Other Cardiac <sup>5</sup>	38.9	37.5	51.1	42.8	34.8	26.0	46.1	22.5	57.3	48.2	34.3
Cerebrovasc. Dis.	13.3	12.8	17.9	11.3	15.3	12.4	13.7	8.7	18.7	17.5	11.0
Septicemia	23.9	22.4	36.2	22.0	26.1	24.1	24.7	17.4	32.5	32.2	19.4
Other Infection	7.0	6.9	8.7	7.7	6.4	5.6	7.7	4.0	10.4	7.7	6.6
AIDS	2.3	2.3	2.9	3.2	1.1	4.1	0.5	3.4	0.2	0.5	2.8
Malignancy	8.4	8.7	6.4	10.1	6.9	7.9	9.3	5.3	12.4	5.3	10.2
Hemorrhage	4.4	4.4	4.3	4.5	4.3	4.1	4.6	2.9	6.1	3.8	4.7
Hyperkalemia	4.7	5.0	4.0	4.4	5.0	2.7	6.0	3.5	5.9	6.2	3.9
Cachexia	2.6	2.4	4.0	2.4	2.9	2.0	3.0	1.2	4.1	2.9	2.4
Other	28.9	28.2	36.0	27.5	30.3	21.6	33.9	18.3	40.5	32.2	27.4
Unknown	15.5	15.3	17.7	15.9	15.2	15.9	15.7	10.7	21.2	20.2	13.0
Missing	26.5	26.7	27.7	27.6	25.4	21.3	29.8	15.9	38.5	32.3	23.6
<b>TOTAL</b>	<b>243.4</b>	<b>238.7</b>	<b>295.1</b>	<b>250.0</b>	<b>237.1</b>	<b>207.4</b>	<b>267.7</b>	<b>159.0</b>	<b>341.2</b>	<b>297.9</b>	<b>215.2</b>

Medicare only patients, 1993-94. Source: Special Analysis

<sup>1</sup> Adjusted for sex, race, age (5-year categories), modality and diabetic status, excludes ages <20.

<sup>2</sup> Excludes patients with a history of prior transplant and on "unknown dialysis".

<sup>3</sup> Categories collapsed from Death Notification Form (HCFA-2746) as per Table VI-1

<sup>4</sup> Death Rates add vertically to the total.

<sup>5</sup> Other cardiac includes pericarditis, atherosclerotic heart disease, cardiomyopathy, cardiac arrhythmia, pulmonary edema, and valvular heart disease.

USRDS 1997

**Table VI-5**

been found among PD treated patients, and has stimulated an interest in increasing the dialysis dose in this population as well (Canada-USA). Differences in case-mix severity among these patient groups may also play a role although a previous study has shown relatively small differences in comorbidity between PD and HD treated incident patients (USRDS 1992; Held 1994).

The all-cause death rate remained higher among male than female dialysis patients (250.0 to 237.1 per 1000 patient years) although this difference has decreased over the past decade (Chapter V). Table VI-5 shows that this difference was mainly attributable to higher adjusted death rates due to acute myocardial infarction, cardiac arrest, other cardiac causes, and malignancy. This is consistent with a previous study that compared cause-specific mortality between males and females (Bloembergen 1994). Of note, the death rates due to cerebrovascular disease were higher among females, which is consistent with the Bloembergen 1994 study. Death rates reported to be due to septicemia were higher among females while death rates due to other infections were higher among males.

The risk of death was also higher (28 percent) among White compared to Black dialysis patients. This has previously been shown to be attributed to an increased risk of death due to acute myocardial infarction, all other cardiac causes, withdrawal from dialysis, and infection (Bloembergen 1994). Table VI-5 confirms that the adjusted death rates for all causes are higher among Whites than Blacks with the exception of AIDS for which death rates are markedly lower for Whites. The largest excess risk for Whites was for "other cardiac causes", acute MI, cardiac arrest, and hyperkalemia. There may be several possible explanations for these observed racial differences in death rates. There may be lower degrees of comorbidity among the Black ESRD population compared to the White ESRD population, either because Blacks reaching ESRD are "healthier" or because of greater acceptance of Whites with comorbid conditions. In addition, a higher transplantation rate among Whites would leave fewer "healthier" patients in the dialysis group compared to Blacks. However, this last possibility explains at most only a small part of the observed difference in death rate, since Table VI-2 shows a markedly higher death rate for Whites in the all ESRD (combined dialysis and transplant) population.

Among dialysis patients, diabetics have substantially higher adjusted death rates due to acute myocardial infarction, cardiac arrest, other cardiac

causes, septicemia, cerebrovascular disease, and hyperkalemia than nondiabetics. However, the death rate due to malignancy is almost two fold higher for nondiabetics than diabetics. As noted before, this is probably related to the competing risk of cardiac, infectious, and vascular causes of death in diabetics.

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## Causes of Death among Transplant Recipients

Table VI-6 shows the cause-specific death rates per 1000 patient years for patients aged 20-44 years with a functioning transplant, a failed transplant, or never transplanted. Prevalent patients with a *functioning transplant* on January 1 of 1993, 1994 or 1995 were classified as such and are followed through the remainder of each year independent of transplant failure that may have occurred in some patient during the year. *Failed transplant* patients were prevalent patients that suffered a transplant failure at least 60 days prior to January 1 of 1993, 1994, and 1995 and remained on dialysis. Never transplanted patients were prevalent and incident patients in each year treated with dialysis who *never received a transplant*. Never transplanted patients who received a transplant during the year of observation were censored on the day of transplantation. At the beginning of the new year a patient censored from the previous year because of a change in status would start contributing years at risk for the new status. All death rates were adjusted for sex, race, and age. Comparison of patients with similar diabetic status reveals markedly lower death rates for each cause of death among patients with a functioning transplant as compared to those among patients never transplanted. This is likely due in part to selection of healthier patients to transplantation (Port 1992; Gaylin 1993; USRDS 1992) and exclusion of transplant failures. In addition to patient selection, other factors such as the greater level of renal functional replacement with transplantation may be playing a role in the better long-term outcomes with transplantation. Death rates for patients with a failed transplant were similar to those never transplanted.

As expected, nondiabetics have lower death rates than diabetics across all causes for functioning transplant patients, failed transplant patients, and never transplanted patients with the exception of patients who have AIDS. Death rates due to AIDS were much lower among diabetics than nondiabetics, probably due to competing risks.

**Adjusted<sup>1</sup> Cause Specific Death Rates<sup>4</sup> for Patients Aged 20-44 with a Functioning Transplant, a Failed Transplant, and Never Transplanted, By Diabetic Status, 1993-1995**

Cause of Death <sup>2</sup>	Functioning Transplant		Failed Transplant		Never Transplanted	
	Diabetic	Non-Diabetic	Diabetic	Non-Diabetic	Diabetic	Non-Diabetic
Acute MI	3.4	0.5	24.1	3.8	14.6	4.0
Cardiac Arrest	2.5	1.0	40.4	7.7	34.6	13.1
Other Cardiac <sup>3</sup>	1.3	0.6	20.5	8.1	19.2	8.5
CVD	2.1	0.5	9.1	3.8	10.6	3.6
Septicemia	1.8	0.8	18.6	6.2	17.9	8.7
AIDS	0.0	0.0	0.0	0.4	1.5	11.4
Other Infection	1.6	0.7	2.6	1.8	3.5	2.6
Malignancy	1.3	0.8	0.4	0.7	0.6	1.6
Hemorrhage	0.6	0.1	2.6	1.4	1.9	1.9
Hyperkalemia	0.3	0.1	9.1	2.2	5.0	2.6
Cachexia	0.1	0.0	1.6	0.1	1.6	0.3
Other	3.2	1.3	16.3	8.1	20.8	10.3
Unknown	2.1	0.7	18.5	4.7	14.3	6.3
Missing	11.2	4.7	17.4	4.7	14.8	8.4
<b>TOTAL<sup>5</sup></b>	<b>31.4</b>	<b>11.9</b>	<b>181.2</b>	<b>53.7</b>	<b>160.7</b>	<b>83.3</b>

Medicare only patients 1993-94. Source: Special Analysis

<sup>1</sup> Adjusted for sex, race and age (5-year categories)

<sup>2</sup> Categories collapsed from Death Notification Form (HCFA-2746) as per Table VI-1

<sup>3</sup> Other cardiac includes pericarditis, atherosclerotic heart disease, cardiomyopathy, cardiac arrhythmia, pulmonary edema, and valvular heart disease.

<sup>4</sup> Death Rates per 1000 patient years. Death Rates add vertically to the total.

<sup>5</sup> This category is unadjusted

USRDS 1997

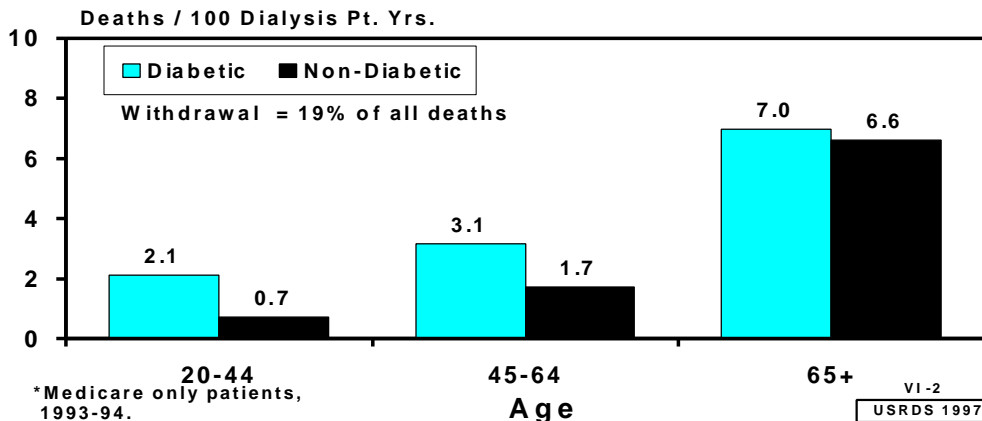
**Table VI-6**

Cardiac causes of death (cardiac arrest, acute MI, other cardiac causes, and cerebrovascular disease) are reported to account for approximately 46 percent of all deaths in diabetic patients ages 20-44 years with a functioning transplant. In contrast, in never transplanted diabetic dialysis patients aged 20-44

years, cardiac causes combined account for approximately 54 percent of deaths. Similar results are seen for nondiabetics (32 percent to 39 percent).

Of interest is that death rates for diabetics with a failed transplant due to all causes are 13 percent

**Rate\* of Withdrawal from Dialysis, by Age and Diabetes Status, 1993-95**



**Figure VI-2**

Death rate due to withdrawal among dialysis patients by age (on January 1 or at incidence) and diabetic status, 1993-95. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only, 1993-94. Source: Reference Table D.6.



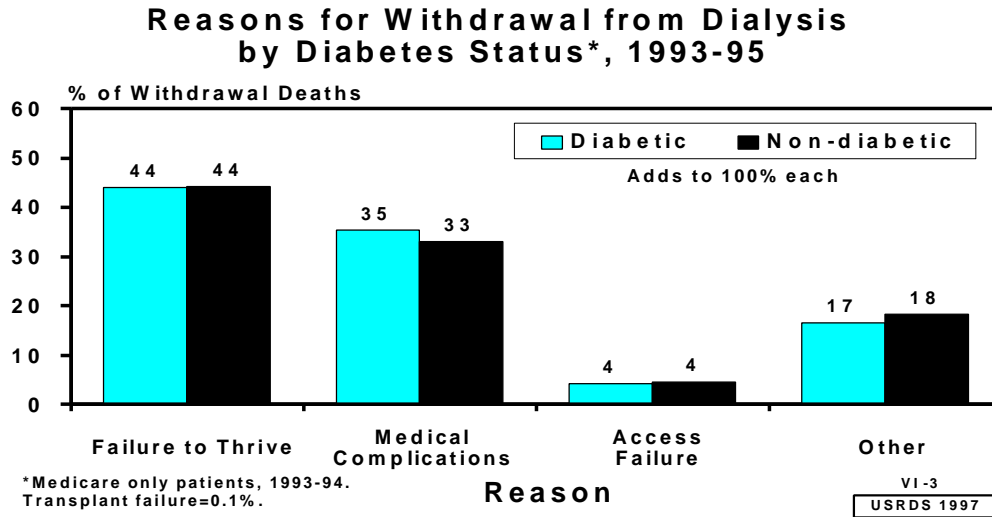


Figure VI-3

Reasons for withdrawal from dialysis by diabetes status, all dialysis patients, 1993-95. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only, 1993-94. Source: Reference Table D.6.

higher among diabetics never transplanted. This is in direct contrast to the nondiabetics population where death rates due to all causes were 35 percent lower among failed transplant patients than never transplanted patients.

### Withdrawal from Dialysis

The new Death Notification Form also provides data on whether or not the patient withdrew from dialysis prior to death. By definition, this does not represent patients who have stopped dialysis because of a return of renal function. Altogether, about 19 percent of patients withdraw from dialysis prior to death due to any cause. Figure VI-2 shows that the rate of withdrawal from dialysis increased with age and was about three times higher in diabetics aged 20-44 years than nondiabetics in the same age group. While diabetes is associated with a higher rate of withdrawal in all age categories, the difference lessens with increasing age. The increase in withdrawal rate with age may be the result of increasing severity of comorbid conditions which may lessen the quality of life of a dialysis patient to the extent that further dialysis may reach questionable benefits (Mailloux 1991; Nelson).

Withdrawal from dialysis also has marked racial variation. Blacks are at half to a third the risk of withdrawal compared to Whites (Nelson; Bloembergen 1994; Leggat 1997a). These

differences are likely due to sociocultural reasons (Leggat 1997b).

The reported reasons for withdrawal from dialysis are shown in Figure VI-3. The distribution of reasons for withdrawing from renal replacement therapy is similar for diabetics and nondiabetics. The leading reason for withdrawal was chronic failure to thrive (44 percent for diabetics and nondiabetics), followed by acute medical complications (35 to 33 percent), and access failure (four percent each). Transplant failure with refusal to return to dialysis was extremely rare (one tenth of a percent) and the remainder were due to undefined or other reasons.

It has been stated that withdrawal from dialysis reflects, on the one hand, failure of renal replacement therapy, and on the other hand maintenance of patient autonomy (Leggat 1997a). In addition, the high rates of withdrawal in the United States (Sehgal) may be due to acceptance of patients for whom benefits from therapy may have been uncertain at initiation of ESRD therapy. As individual patient outcome is not predictable, some have advocated an approach of liberal acceptance policies combined with a willingness to support patients in their decision to withdraw from dialysis (Port 1994).

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