

National Surveillance of Dialysis-Associated Diseases in the United States, 1999

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SUMMARY

National Surveillance of Dialysis-Associated Diseases in the United States, 1999

- See summary of selected results (Table 1).
- This survey was performed yearly during 1982-1997 and in 1999 by the Centers for Disease Control and Prevention (CDC) and the Health Care Financing Administration (HCFA).
- **Hepatitis B vaccine use.** During 1997-1999, the percent of patients vaccinated increased from 47% to 55% and the percent of staff vaccinated increased from 87% to 88%.
- **Influenza and pneumococcal pneumonia vaccines** (data first collected in 1999). In 1999, an estimated 67% of patients had been vaccinated for influenza and 29% for pneumococcal pneumonia.
- **Hepatitis C virus.** In 1999, routine testing for antibody to hepatitis C virus (anti-HCV) was performed on staff at 36% of centers and on patients at 56% of centers. At centers testing, anti-HCV was found in 1.9% of staff and 8.9% of patients.
- **Vascular access.** During 1995-1999, the percentage of patients who received dialysis through central catheters increased from 13% to 22%; this trend is worrisome since infections and antimicrobial use are higher in patients receiving dialysis through catheters. However, during the same period, the percentage of patients receiving dialysis through fistulas increased from 22% to 26%.
- **Reasons for the use of catheters** (data first collected in 1999). In 1999, 26% of catheters were used for new patients awaiting an implanted access, 27% for established patients with a failed access awaiting a new implanted access, 42% as an access of last resort, and 7% for other reasons, including patient preference.
- **Vancomycin use.** The median percentage of patients reported to have received vancomycin during December decreased from 5.6% in 1995 to 4.3% in 1999.
- **Vancomycin-resistant enterococcus (VRE).** The percent of centers reporting one or more patients infected or colonized with VRE increased from 11.5% in 1995 to 34.1% in 1999.
- **The Dialysis Surveillance Network.** Because of the importance of these issues, CDC developed a voluntary surveillance system that has been in operation since August 1999. See Appendix II for more details.

Table 1. Summary

National Surveillance of Dialysis-Associated Diseases, 1995-1999, United States

Category	Unit of Measurement	Year		
		1995	1997	1999
Centers responding to survey	number of centers	2,647	3,077	3,483
Reuse dialyzers	% of centers	77	82	80
Total staff, all centers (end of year)	number of staff	43,465	50,321	52,368
Hepatitis B vaccination, staff	% of staff	82*	87*	88*
Test staff for anti-HCV	% of centers	16	25	36
Anti-HCV prevalence, staff	% of staff	2.0	1.6	1.9
Total patients, all centers (end of year)	number of patients	162,970	195,935	225,226
Vascular access	% of patients			
Arteriovenous graft		65	60	52
Arteriovenous fistula		22	23	26
Central catheter		13	17	22
Hepatitis B vaccination, patients	% of patients	35*	47*	55*
Influenza vaccination, patients	estimated % of patients vaccinated	-	--	67
Pneumococcal pneumonia vaccination, patients		--	--	29
Test patients for anti-HCV	% of centers	39	48	56
Anti-HCV prevalence, patients	% of patients	10.4	9.3	8.9
HIV infection	% of patients	1.4	1.3	1.4
AIDS	% of patients	0.7	0.6	0.5
Vancomycin use, December	% of patients, median	5.6	4.5	4.3
Vancomycin-resistant enterococcus (VRE)	% of centers with \$1 patients	11.5	29.8	34.1
Methicillin-resistant <i>Staphylococcus aureus</i>		40	56	67

Anti-HCV denotes antibody to hepatitis C virus; HIV denotes human immunodeficiency virus; AIDS denotes acquired immunodeficiency syndrome.

* For 1997 and 1999, included patients treated, or staff members working, at the end of the year. For 1995, included staff and patients from throughout the year.

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) has been conducting surveillance of hemodialysis-associated hepatitis since the early 1970s (1), when CDC reported that the incidence of HBV infection among patients and staff during 1972-1974 had increased by more than 100%, to 6.2% and 5.2%, respectively. These early surveys had only a 50% to 65% response rate of centers listed by the National Dialysis Registry. In an effort to obtain a higher response rate, and thus more complete information, CDC initiated a cooperative program with the Health Care Financing Administration (HCFA) in 1976 that provided for a questionnaire from CDC to be included in HCFA's annual facility survey. As a result of this collaboration, the response rates to the CDC questionnaire now exceed 90%.

Since collaboration with HCFA was begun, the CDC survey has been performed for calendar years 1976, 1980, 1982 to 1997, and 1999 (2-12). Other hemodialysis-associated diseases and practices not related to hepatitis have been included over the years, and the questionnaire is continually updated to collect data about hemodialysis practices and hemodialysis-associated diseases of current interest and importance. The objectives of this yearly survey are to (a) determine the frequency with which certain hemodialysis practices are used, including measures designed to prevent disease, (b) determine the frequency of hemodialysis-associated complications and diseases, and (c) use this information to suggest further measures to prevent complications and disease in hemodialysis patients and staff.

METHODS

In conjunction with the annual facility survey performed by HCFA for calendar year 1999, CDC distributed a questionnaire (see Appendix I) by mail to all chronic hemodialysis centers licensed by HCFA. All responses were reviewed, and approximately 10% of centers that responded provided inaccurate or inconsistent responses and were contacted for clarification of responses. The survey covered:

- a. hemodialysis practices, reuse of disposable dialyzers, type of vascular access, procedures for cleaning and disinfection of dialysis equipment.
- b. use of hepatitis B virus, pneumococcal pneumonia, and influenza vaccines in

- patients.
- c. the results of testing patients for hepatitis B surface antigen (HBsAg), antibody to HBsAg (anti-HBs), and antibody to hepatitis C virus (anti-HCV).
 - d. the number of patients who received vancomycin in December 1999, and whether \$1 patients with vancomycin-resistant enterococcus (VRE) or methicillin-resistant *Staphylococcus aureus* (MRSA) were treated during 1999.
 - e. the number of patients with human immunodeficiency virus (HIV) infection.
 - f. in staff members, receipt of hepatitis B vaccine, and testing for anti-HCV.

Survey questions on hepatitis B vaccination and the prevalence of HIV infection/AIDS were changed for the 1997 and 1999 surveys, and referred only to patients treated or staff members who worked during a one-week period in December (in 1999, this was December 6-11) of the survey year; in previous years, the questions referred to patients and staff present in the unit at any time during the year.

In 1999, the incidence of hepatitis B virus (HBV) infection was defined as the number of patients who became positive for HBsAg during 1999 divided by the number of patients treated at the facility during December 6-11, 1999; in effect, the number of patients treated during the one-week period in December 1999 was used as an estimate of the average census at that dialysis center during 1999. In previous years, the denominator for this incidence rate was the total number of patients treated at the facility at any time during the year.

The prevalence rates of chronic HBV infection and immunity were defined as the percentage of all patients or staff present in the facility during December 6-11, 1999, who were positive for HBsAg or anti-HBs, respectively. All patients or staff (regardless of their susceptibility to HBV infection) were included in calculations of the incidence and prevalence of HBV infection. Among groups of dialysis centers, the median percent of patients receiving vancomycin in December 1999 was calculated by weighting each dialysis center by the number of patients treated.

Information on dialysis center location and ownership was obtained from the HCFA End Stage Renal Disease (ESRD) Facility Survey dataset. The results of the 1999 survey were compared to results from previous surveys. For administrative purposes, HCFA has designated 18

ESRD Networks, each composed of 51 U.S. states, districts or territories(13); to evaluate differences in practices and diseases among centers in different geographic regions, analyses were performed according to ESRD Network.

Proportions were compared with the chi square or Fisher's exact test; when adjustment for confounding variables was required, the Mantel-Haenszel test or logistic regression was used. All p-values were two-tailed; a p-value of <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Questionnaires were returned by 3,483 (94%) of 3,668 centers. These 3,483 centers represented 225,226 patients and 52,368 staff members. During 1987-1999, the median number of patients per center increased from 40 to 56 and the median number of staff members per center increased from 12 to 13 (Table 2).

Table 2. Numbers of Hemodialysis Centers, Patients, and Staff Members Surveyed, 1985-1999, United States

Year	No. of Centers	Patients		Staff Members	
		Total Patients	Median per Center	Total Staff	Median per Center
1985	1,250	62,172	—*	20,346	—
1986	1,350	67,387	--	21,094	--
1987	1,486	74,249	40	22,334	12
1988	1,586	80,651	41	23,778	12
1989	1,726	90,596	42	26,112	12
1990	1,882	101,763	43	29,252	13
1991	2,046	116,651	46	33,079	13
1992	2,170	128,264	49	36,000	14
1993	2,304	135,798	49	37,992	14
1994	2,449	149,743	51	40,951	14
1995	2,647	162,970	51	43,465	14
1996	2,808	177,324	53	47,215	14
1997	3,077	195,935	54	50,321	14
1999	3,483	225,226	56	52,368	13

The numbers of patients and staff members reflect the numbers present during a one-week period in December of the year.

* Data not available.

During 1985-1999, the proportion of freestanding (i.e., located outside the hospital) centers increased from 56% to 80%, and the proportion of centers operating for profit increased from 46% to 75% (Table 3).

Table 3. Location and Ownership of Hemodialysis Centers, 1985-1999, United States

Year	Location		Ownership		
	Hospital	Freestanding	Profit	Nonprofit	Government
	<i>percent of hemodialysis centers</i>				
1985	44	56	46	44	11
1986	42	58	49	41	10
1987	39	61	51	40	9
1988	37	63	53	39	8
1989	35	65	55	38	7
1990	34	66	56	37	7
1991	35	65	56	35	9
1992	33	67	57	34	9
1993	31	69	62	32	6
1994	29	71	62	31	6
1995	27	73	63	30	7
1996	26	74	66	28	6
1997	23	77	70	25	5
1999	20	80	75	21	4

Dialyzer Types

During December 6-11, 1999, the most common dialyzer types were high flux polysulfone (e.g., F60, F80, 50% of patients) and low flux polysulfone (e.g., F5, F8; 20.9% of patients) (Table 4).

Table 4. Dialyzer Types, December 6-11, 1999, United States

Dialyzer Type	Percent of Patients Treated With
High flux polysulfone	50.0
Low flux polysulfone	20.9
Cellulose acetate	11.5
Cellulose triacetate	8.4
Regenerated cellulose, cuprophan	6.5
Hemophan	0.9
PMMA	0.2
Other	3.4

Dialyzer Reuse

During 1976-1997, the percentage of centers that reported reuse of disposable dialyzers increased from 18% to 82%, but decreased slightly to 80% in 1999 (Table 5). Although dialyzer reuse has been implicated in numerous outbreaks, this practice is safe if performed according to recognized protocols (14,15).

Table 5. Hemodialysis Centers Having Dialyzer Reuse Programs, 1976-1999, United States

Year	No. of Centers	No. (%) Reusing Dialyzers
1976	750	135 (18)
1980	956	179 (19)
1982	1,015	435 (43)
1983	1,120	579 (52)
1984	1,201	693 (58)
1985	1,250	764 (61)
1986	1,350	855 (63)
1987	1,486	948 (64)
1988	1,586	1,058 (67)
1989	1,726	1,172 (68)
1990	1,882	1,310 (70)
1991	2,046	1,453 (71)
1992	2,170	1,569 (72)
1993	2,304	1,688 (73)
1994	2,449	1,835 (75)
1995	2,647	2,048 (77)
1996	2,808	2,261 (81)
1997	3,077	2,523 (82)
1999	3,478	2,788 (80)

Methods Used for Reprocessing Dialyzers

During 1983-1999, the proportion of centers using formaldehyde for reprocessing dialyzers decreased from 94% to 33%, while the proportion using a peracetic acid product increased from 5% to 58% (Table 6). In 1999, 3% of centers used heat to disinfect dialyzers between reuses.

Table 6. Methods for Reprocessing Dialyzers in Hemodialysis Centers, 1983-1999, United States

Year	Percent of Centers Using Method			
	Formaldehyde	Peracetic Acid	Glutaraldehyde	Heat
1983	94	5	<1	--
1984	86	12	3	--
1985	80	17	3	--
1986	69	28	3	--
1987	62	34	4	--
1988	54	40	6	--
1989	47	46	7	--
1990	43	49	8	--
1991	42	50	9	--
1992	40	52	8	<1
1993	40	51	8	1
1994	40	52	7	1
1995	38	54	7	1
1996	36	54	7	3
1997	34	56	7	3
1999	33	58	6	3

Vascular Access Types

During December 6-11, 1999, 51.9% of patients received dialysis through an arteriovenous graft, 26.0% through an arteriovenous fistula, and 22.2% through a temporary or permanent central catheter (Table 7). Since 1995, the percent of patients receiving dialysis through catheters increased from 12.7% to 22.2%.

In 1999, 25.6% of catheters were used for new patients awaiting an implanted access (i.e., a fistula or graft), 27.3% for established patients with a failed access awaiting a new implanted access, 42.2% as an access of last resort, and 6.6% for other reasons, including patient preference.

Among the 18 ESRD networks designated by HCFA (see Methods), use of fistulas (the most desirable access type) ranged from 18.3% to 38.2% (Table 8). The estimated risk of access-related bacteremia was calculated by using rates measured in the Dialysis Surveillance Network(16), a voluntary surveillance system for monitoring bacterial infections and related events in hemodialysis patients (Appendix II); the rates used for this calculation were 0.22 access-related bacteremias per 100 patient-months for fistulas, 0.48 for grafts, 5.25 for noncuffed catheters, and 8.85 for cuffed catheters (unpublished data, CDC). Network 17 had the lowest estimated risk and Network 9 the highest; note that the estimated risk of vascular access infection is most closely related to the percentage of patients receiving dialysis through cuffed catheters.

Table 7. Types of Vascular Access Used for Hemodialysis, 1995-1999, United States.

Year	Number of Patients	Percent of Patients Receiving Dialysis Through		
		Fistula	Graft	Catheter
1995	153,320	22.2	65.1	12.7
1996	176,609	22.1	62.9	14.9
1997	195,588	22.8	59.7	17.5
1999	225,226	26.0	51.9	22.2

Table 8. Vascular Access Types by End Stage Renal Disease (ESRD) Network, December 1999, United States

ESRD Network	States, Districts, or Territories	No. of Patients	Percent of Patients Receiving Dialysis Through				Estimated Risk of Access-Related Bacteremia*
			Fistula	Graft	Noncuffed Catheter	Cuffed Catheter	
17	AS, GU, HI, CA (northern)	11,283	28.1	56.1	3.8	11.9	1.6
18	CA (southern)	16,605	23.4	60.3	3.3	13.4	1.7
14	TX	18,825	18.3	64.5	2.4	14.8	1.8
8	AL, MS, TN	13,011	19.3	63.0	3.3	14.6	1.8
2	NY	17,041	36.4	44.8	2.2	16.8	1.9
16	AK, ID, MT, OR, WA	5,392	35.8	45.7	0.9	17.7	1.9
15	AZ, CO, NM, NV, UT, WY	8,235	31.5	48.1	2.2	18.3	2.0
6	GA, NC, SC	20,418	23.1	55.2	3.0	19.0	2.2
5	DC, MD, VA, WV	14,637	21.0	56.4	3.7	19.0	2.2
1	CT, MA, ME, NH, RI, VT	8,284	38.2	38.7	3.1	20.0	2.2
13	AR, LA, OK	10,330	21.2	55.2	3.4	20.2	2.3
11	MI, MN, ND, SD, WI	13,401	25.7	49.4	4.1	21.1	2.4
10	IL	9,841	25.2	48.9	5.0	21.1	2.4
7	FL	13,167	26.9	47.0	3.5	22.8	2.5
3	NJ, PR	10,331	31.0	40.9	6.9	21.2	2.5
12	IA, KS, MO, NE	7,136	26.7	46.4	2.4	24.5	2.6
4	DE, PA	10,965	26.7	45.7	2.3	25.4	2.6
9	IN, KY, OH	15,967	25.5	46.5	2.5	25.5	2.7
	All	224,869	26.0	51.9	3.2	19.0	2.2

AS denotes American Samoa, GU denotes Guam.

* Estimated vascular access-related bacteremias per 100 patient-months. See text for details of the calculation.

Rows are sorted by this estimate.

Use of Pneumococcal Vaccine

In 1999, pneumococcal vaccine was offered to patients at 64.5% of centers, which included 18.4% of centers with <25% of patients vaccinated, 10.9% with 25-49% vaccinated, 11.0% with 50-74% vaccinated, 17.1% with \$75% vaccinated, and 7.1% with percent vaccinated unknown.

The percent of patients vaccinated was estimated by assuming that 0% of patients were vaccinated at centers not offering the vaccine, 12.5% were vaccinated at centers with <25% vaccinated, 37.5% at centers with 25-49% vaccinated, 67.5% at centers with 50-74% vaccinated, and 87.5% at centers with \$75% vaccinated. Overall, the estimated percent vaccinated was 28.9% (range 12.5%-41.6% among the ESRD Networks, Table 9).

Table 9. Use of Pneumococcal Vaccine In Patients by End Stage Renal Disease (ESRD) Network, 1999, United

States

ESRD Network	States, Districts, or Territories	No. of Centers	Offer Vaccine to Patients (% of Centers)	Estimated Percentage of Patients Vaccinated
17	AS, GU, HI, CA (northern)	137	32.1	12.5
3	NJ, PR	111	60.4	18.1
18	CA (southern)	193	50.3	20.6
6	GA, NC, SC	323	55.4	21.8
13	AR, LA, OK	222	57.7	24.5
5	DC, MD, VA, WV	249	61.8	27.0
10	IL	109	65.1	28.8
1	CT, MA, ME, NH, RI, VT	119	69.7	28.9
15	AZ, CO, NM, NV, UT, WY	140	59.3	29.8
7	FL	229	72.5	30.1
8	AL, MS, TN	243	68.7	30.2
16	AK, ID, MT, OR, WA	100	59.1	32.2
2	NY	189	66.1	33.8
14	TX	257	72.8	34.3
4	DE, PA	188	72.3	34.7
9	IN, KY, OH	243	67.5	37.4
11	MI, MN, ND, SD, WI	257	80.5	38.1
12	IA, KS, MO, NE	161	73.9	41.6
	All	3,474	64.5	28.9

AS denotes American Samoa, GU denotes Guam.

Rows are sorted by estimated percentage of patients vaccinated.

Use of Influenza Vaccine

In 1999, influenza vaccine was offered to patients at 95.1% of centers, which included 4.4% of centers with <25% of patients vaccinated, 9.6% with 25-49% vaccinated, 24.5% with 50-74% vaccinated, 53.3% with \geq 75% vaccinated, and 3.3% with percent vaccinated unknown (Table 10). The percent of patients vaccinated was estimated using methods similar to that outlined under “Use of Pneumococcal Vaccine.” Overall, the estimated percent vaccinated was 67.4% (range 54.9-74.7% among the ESRD networks, Table 10).

Table 10. Use of Influenza Vaccine in Patients by End Stage Renal Disease (ESRD) Network, 1999, United States

ESRD Network	States, Districts, or Territories	No. of Centers	Offer Vaccine to Patients (% of Centers)	Estimated Percentage of Patients Vaccinated
17	AS, GU, HI, CA (northern)	137	78.1	54.9
10	IL	108	94.4	56.6
16	AK, ID, MT, OR, WA	100	78.0	57.0
7	FL	229	90.8	58.0
3	NJ, PR	111	98.2	59.2
18	CA (southern)	195	95.4	63.2
5	DC, MD, VA, WV	250	89.6	64.9
6	GA, NC, SC	326	95.4	68.4
8	AL, MS, TN	244	98.8	69.0
2	NY	191	96.3	69.7
1	CT, MA, ME, NH, RI, VT	119	99.2	71.2
11	MI, MN, ND, SD, WI	257	98.4	71.4
13	AR, LA, OK	222	95.0	72.3
9	IN, KY, OH	243	99.6	72.3
4	DE, PA	187	99.5	73.6
15	AZ, CO, NM, NV, UT, WY	141	96.5	74.5
12	IA, KS, MO, NE	161	95.7	74.6
14	TX	256	100.0	74.7
	All	3481	95.1	67.4

AS denotes American Samoa, GU denotes Guam.

Rows are sorted by estimated percentage of patients vaccinated

Use of Hepatitis B Vaccine

In 1999, policies for vaccination of chronic hemodialysis patients were as follows: 94.6% of centers offered vaccine to patients; in 1.7% of centers vaccine was offered at individual physician's offices; 2.2% of centers did not offer vaccine to patients; and 1.6% of centers reported other policies.

During 1983-1999, the proportion who had ever received at least three doses of hepatitis B vaccine increased from 5% to 55% among patients and from 26% to 88% among staff (Table 11). Note that the survey questions on vaccination of patients and staff were changed for the 1997 and 1999 surveys. During 1983-1996, the percent of patients vaccinated was calculated as the number of vaccinated patients treated at any time during the year divided by the total number of patients treated at any time during the year. In 1997 and 1999, the percent of patients vaccinated was calculated as the number of vaccinated patients who were present during a one-week period in December divided by the total number of patients present during the same one-week period in December. Similar methods were used to calculate the percents of staff vaccinated during the two time periods (1983-1996 vs 1997-1999). The vaccination data may be more accurate for 1997 and 1999 than for previous years, since determination of vaccine status in December of the year, at the time the survey is completed, should be more accurate than determining vaccine status for patients treated (or staff members who worked) at any time during the year, as was requested in previous surveys.

Table 11. Use of Hepatitis B Vaccine in Hemodialysis Centers, 1983-1999, United States

Year	No. (%) Ever Receiving 3 Doses of Vaccine	
	Patients	Staff Members
1983	3,619 (5.4)	5,670 (26.1)
1984	4,495 (6.0)	7,181 (31.6)
1985	6,290 (7.8)	8,521 (35.5)
1986	8,815 (10.1)	9,877 (39.4)
1987	12,270 (12.8)	11,316 (41.9)
1988	17,019 (15.8)	12,949 (45.5)
1989	21,623 (17.6)	15,578 (48.0)
1990	24,260 (18.2)	19,311 (53.0)
1991	25,397 (16.9)	22,499 (56.1)
1992	37,459 (23.6)	30,069 (69.4)
1993	47,183 (28.8)	34,885 (76.1)
1994	61,492 (31.0)	40,008 (79.6)
1995	74,217 (35.0)	44,542 (82.4)
1996	79,133 (36.0)	48,817 (81.9)
1997*	87,749 (46.7)	43,341 (86.6)
1999*	116,920 (55.3)	45,735 (88.5)

* Methods differed in 1983-1996 vs 1997-1999 (see text for details).

Among the ESRD networks, hepatitis B vaccination among patients in 1999 varied from 38.8% to 66.7% (Table 12). The largest absolute increase in vaccination during 1997-1999 occurred in ESRD network 18.

Table 12. Use of Hepatitis B Vaccine in Hemodialysis Patients by End Stage Renal Disease (ESRD) Network, 1995-1997, United States

ESRD Network	States, Districts, or Territories	Percent Vaccinated		Absolute Change
		1997	1999	
10	IL	31.5	38.8	7.3
3	NJ, PR	37.4	41.5	4.1
2	NY	36.5	43.7	7.2
18	CA (southern)	29.9	52.2	22.3
5	DC, MD, VA, WV	45.5	52.6	7.1
17	AS, GU, HI, CA (northern)	39.0	54.7	15.7
15	AZ, CO, NM, NV, UT, WY	42.8	56.2	13.4
7	FL	52.0	56.4	4.4
9	IN, KY, OH	47.7	57.2	9.5
1	CT, MA, ME, NH, RI, VT	47.2	57.3	10.1
11	MI, MN, ND, SD, WI	54.1	57.4	3.3
6	GA, NC, SC	54.5	57.6	3.1
13	AR, LA, OK	50.9	57.6	6.7
4	DE, PA	53.0	58.0	5.0
8	AL, MS, TN	53.7	61.7	8.0
16	AK, ID, MT, OR, WA	58.0	62.5	4.5
14	TX	55.0	65.2	10.2
12	IA, KS, MO, NE	55.2	66.7	11.5
	All	46.7	55.3	8.6

AS denotes American Samoa, GU denotes Guam.

Prevalence of Antibody to Hepatitis B Surface Antigen (anti-HBs)

During 1980-1999, the prevalence of anti-HBs among patients increased from 11.3% to 36.8% (Table 13). The presence of anti-HBs indicates immunity to HBV infection, either from vaccination or as a result of recovery from infection with natural infection (17).

Table 13. Prevalence of Antibody to Hepatitis B Surface Antigen in Hemodialysis Patients and Staff, 1980-1999, United States

Year	Patients		Staff Members	
	Number Tested	Prevalence (%)	Number Tested	Prevalence (%)
1980	43,796	11.3	15,603	16.1
1982*	49,275	12.3	16,235	18.1
1983	54,343	18.3	18,714	39.2
1984	60,782	19.5	19,793	43.6
1985	62,172	17.7	20,346	45.9
1986	59,425	17.9	20,456	47.4
1987	67,387	18.3	21,761	49.6
1988	71,262	19.9	23,012	53.6
1989	81,672	19.1	25,355	54.0
1990	90,661	19.7	28,470	58.1
1991	101,888	21.2	31,872	62.7
1992	102,337	24.2	32,916	70.4
1993	114,528	28.7	35,589	78.1
1994	130,798	28.9	36,804	78.4
1995	144,607	30.8	38,627	79.2
1996	158,545	32.0	40,328	77.6
1997	163,937	33.3	38,638	78.1
1999	207,293	36.8	Not collected	Not collected

* Hepatitis B vaccine introduced

Incidence and Prevalence of HBV Infection

In 1999, 80.4% of centers reported screening susceptible patients monthly for HBsAg, 0.7% bimonthly, 13.2% quarterly, 4.2% semiannually, and 1.4% other or none.

During 1976-1999, the incidence of HBV infection in patients decreased from 4.4% to 0.06%, with the largest decline occurring during 1976-1980 (Table 14). Note that in 1999 the denominator for the HBsAg incidence rate was the number of patients treated during a one-week period in December of the year, while in prior years it was the number of patients treated throughout the year.

During 1976-1999, the prevalence of HBsAg-positivity among patients declined from 7.8% to 0.9% (Table 14).

In 1999, 3.3% of centers reported \$1 patients with newly acquired (incident) HBV infection, 24.1% of centers reported \$1 patients with chronic (prevalent) HBV infection, and 25.5% of centers reported \$1 patients with either acute or chronic HBV infection.

This national surveillance project was initiated primarily because of the high incidence of HBV infection reported among hemodialysis patients and staff in the early 1970s (1). Hemodialysis patients may acquire HBV infection from community sources or from transmission in hemodialysis centers due to inadequate infection control precautions (18-20) or to accidental breaks in technique (21). Factors contributing to the decline in HBV infection since the 1970s have been previously reviewed (9).

Table 14. Incidence and Prevalence of Hepatitis B Virus Infection in Hemodialysis Patients, 1976-1999, United

States

Year	Incidence		Prevalence	
	Total Patients	Incidence (%)	Total Patients	Prevalence (%)
1976	33,875	3.0	22,876	7.8
1980	62,723	1.0	43,796	3.8
1982	66,326	0.5	49,275	2.7
1983	67,229	0.5	54,343	2.4
1984	76,327	0.3	60,782	2.3
1985	80,151	0.3	62,172	2.1
1986	87,505	0.3	67,387	1.9
1987	97,225	0.2	74,249	1.7
1988	107,804	0.2	80,651	1.5
1989	122,734	0.1	90,596	1.4
1990	140,608	0.2	101,763	1.2
1991	155,877	0.2	116,651	1.3
1992	170,028	0.1	128,264	1.2
1993	180,341	0.1	135,798	1.2
1994	206,884	0.1	149,743	1.1
1995	224,954	0.06	162,970	1.1
1996	229,527	0.08	177,324	1.1
1997	253,001	0.05	195,935	0.9
1999	225,226*	0.06	225,226	0.9

* Denominator changed for 1999 survey. See text.

Hepatitis C

In 1999, 56% of centers tested patients for anti-HCV, and the prevalence of anti-HCV at these centers was 8.9%; 36% of centers tested staff for anti-HCV, and the prevalence of anti-HCV at these centers was 1.9% (Table 15). Among centers that tested for anti-HCV, 12.2% reported having \$1 patients who became anti-HCV positive in 1999 (i.e., tested positive for anti-HCV in 1999 and had previously tested negative).

Anti-HCV prevalence among patients was similar at centers that reused (8.9%) and did not reuse (8.5%) dialyzers ($p=0.6$ controlling for center size). Anti-HCV prevalence among staff was similar at centers that reused (2.0%) and did not reuse (1.8%) dialyzers ($p=0.4$).

Among centers that reused dialyzers, 1,973 (72.4%) reused them on patients that were anti-HCV positive, 406 (14.9%) did not reuse them on anti-HCV positive patients, and 348 (12.8%) did not have any anti-HCV-positive patients. The prevalence of anti-HCV was higher at centers that reused vs those that did not reuse dialyzers on anti-HCV-positive patients (9.4% vs 7.9%, $p=0.012$ controlling for center size and ESRD network). The percent of centers with \$1 patients who became anti-HCV positive in 1999 was higher among centers that reused dialyzers on anti-HCV positive patients (13.8%) than on centers that did not (10.1%, $p=0.1$), but the difference was not statistically significant. Since reprocessed dialyzers are reused on the same patient, it is unclear why reuse would be associated with higher rates of HCV infection among patients. This association could be due to unmeasured confounding factors or related to environmental contamination resulting from improper handling (e.g., transport of used dialyzers to a reprocessing area without placing them in leakproof containers).

Table 15. Antibody to Hepatitis C Virus Testing and Prevalence among Hemodialysis Patients and Staff, 1992-1999, United States

Group	Year	% of Centers Testing	Total Tested	No. (%) Positive
Patients	1992	22	27,086	2,202 (8.1)
	1993	29	37,654	3,654 (9.7)
	1994	34	50,438	5,306 (10.5)
	1995	39	61,400	6,362 (10.4)
	1996	44	75,601	7,652 (10.1)
	1997	48	91,098	8,434 (9.3)
	1999	56	120,871	10,726 (8.9)
	Staff	1992	10	2,889
1993		15	4,825	75 (1.6)
1994		16	5,679	106 (1.9)
1995		16	6,238	122 (2.0)
1996		20	8,472	113 (1.3)
1997		25	11,649	190 (1.6)
1999		36	16,804	327 (1.9)

Among the ESRD networks, anti-HCV prevalence ranged from to 5.6 to 11.3% (Table 16).

Table 16. Prevalence of Antibody to Hepatitis C Virus (anti-HCV) Among Hemodialysis Patients by End Stage Renal Disease (ESRD) Network, 1999, United States

ESRD Network	States, Districts, or Territories	Total Tested	Anti-HCV Positive (%)
2	NY	11,515	11.3
5	DC, MD, VA, WV	8,369	11.2
14	TX	11,129	10.6
3	NJ, PR	5,358	10.3
13	AR, LA, OK	6,497	9.9
4	DE, PA	6,348	9.8
11	MI, MN, ND, SD, WI	6,588	9.3
7	FL	7,778	8.8
8	AL, MS, TN	7,038	8.3
17	AS, GU, HI, CA (northern)	6,258	8.3
12	IA, KS, MO, NE	2,900	8.2
18	CA (southern)	8,096	7.6
6	GA, NC, SC	12,174	7.4
1	CT, MA, ME, NH, RI, VT	4,538	7.0
16	AK, ID, MT, OR, WA	2,561	6.8
10	IL	3,571	6.7
15	AZ, CO, NM, NV, UT, WY	3,965	6.7
9	IN, KY, OH	6,142	5.6
	All	120,871	8.9

AS denotes American Samoa, GU denotes Guam.

Place of Preparation of Injectable Medications

In 1999, medications from multidose vials were most commonly drawn into syringes in preparation for patient administration in a separate medication room or in a medication area separate from the dialysis stations (72.3% of centers), at the dialysis stations (10% of centers), or on a medication cart which is wheeled from patient dialysis station to dialysis station (17.8% of centers).

The place where medications were drawn up was not associated with HBV incidence. However, use of a medication cart was associated with a higher anti-HCV prevalence and with a larger percent of centers with ≥ 1 patients who became anti-HCV positive in 1999 (Table 17).

Table 17. Place Where Injectable Medications Were Prepared and Association with Hepatitis B Virus and Hepatitis C Virus Infection, 1999, United States

Place Where Medication Drawn Up Into Syringe	HBsAg Incidence, No. (%) of Patients	Anti-HCV Prevalence, No. (%) of Patients*	Had Patients Who Became Anti-HCV Positive in 1999, No. (%) of Centers*
Separate medication room or area	87 (0.059)	6,898 (8.6)	145 (10.3)
Dialysis station	16 (0.066)	1,178 (9.1)	23 (11.2)
Medication cart	30 (0.061)	2,623 (9.7)†	56 (15.8)†

HBsAg denotes hepatitis B surface antigen, anti-HCV denotes antibody to hepatitis C virus.

* Analysis limited to centers that test for anti-HCV.

† P<0.05 compared with separate medication room.

Vancomycin Use

The median percent of patients receiving vancomycin in December decreased from 5.6% in 1995 to 4.3% in 1999 (Table 18). In 1999, vancomycin use varied among the ESRD networks from 2.4% of patients in network 17 to 5.8% of patients in network 7 (Table 19).

Table 18. Receipt of Vancomycin by Chronic Hemodialysis Patients, by Year, 1995-1999, United States

Year	Percent of Patients Receiving Vancomycin During December (median)
1995	5.6
1996	5.1
1997	4.5
1999	4.3

Table 19. Receipt of Vancomycin by Chronic Hemodialysis Patients by End Stage Renal Disease (ESRD) Network, December 1997 and 1999, United States

ESRD Network	States, Districts, or Territories	Total Centers in 1999	Received Vancomycin*		Absolute Change
			1997	1999	
17	AS, GU, HI, CA (northern)	136	2.7	2.4	-0.3
18	CA (southern)	180	3.5	2.7	-0.8
16	AK, ID, MT, OR, WA	100	3.4	3.8	0.4
11	MI, MN, ND, SD, WI	245	4.5	3.9	-0.6
8	AL, MS, TN	223	4.0	4.0	0
14	TX	245	3.4	4.0	0.6
4	DE, PA	180	4.5	4.3	-0.2
1	CT, MA, ME, NH, RI, VT	115	4.5	4.4	-0.1
5	DC, MD, VA, WV	243	4.7	4.4	-0.3
6	GA, NC, SC	295	4.5	4.4	-0.1
2	NY	180	5.6	4.5	-1.1
9	IN, KY, OH	233	5.5	4.6	-0.9
12	IA, KS, MO, NE	157	5.0	4.6	-0.4
15	AZ, CO, NM, NV, UT, WY	133	3.9	4.7	0.8
10	IL	100	4.4	5.0	0.6
13	AR, LA, OK	210	5.4	5.1	-0.3
3	NJ, PR	111	6.9	5.7	-1.2
7	FL	215	6.1	5.8	-0.3
	All	3,305	4.5	4.3	-0.2

AS denotes American Samoa, GU denotes Guam.

* Median percent of patients receiving vancomycin in December of 1997 or 1999 (rows are sorted on this value for 1999).

Antimicrobial Use Policies

In 1999, 93.6% of centers reported using \$1 measures to encourage judicious antimicrobial use. Antimicrobial use policies included: the reason for the antimicrobial must be recorded in the patient's chart or on an order form, 63.9% of centers; a written policy on antimicrobial use, 41.7% of centers; automatic stop order (i.e., antimicrobials must be reordered at intervals), 30.8% of centers; formulary restriction (i.e., only selected antimicrobials are available), 30.5% of centers; and approval needed for certain antimicrobials, 23.6% of centers.

The median percentage of patients receiving vancomycin in December 1999 was slightly lower at centers having a written policy on antimicrobial use (4.1%) than at centers not having such a policy (4.5%, $p=0.048$). There were no significant differences in vancomycin use associated with other antimicrobial use measures (data not shown).

Vancomycin-Resistant Enterococci (VRE)

In 1999, the number of patients with known VRE was as follows: no known patients with VRE, 65.9% of centers; 1-4 patients with VRE, 31.6% of centers; 5-9 patients with VRE, 1.9% of centers; and ≥ 10 patients with VRE, 0.5% of centers. At centers having ≥ 1 VRE-positive patients, VRE-positive patients were never treated in a separate room at 64.4% of centers, sometimes in a separate room at 13.5% of centers, and always in a separate room at 22.2% of centers. Rectal swab or stool cultures to check for VRE were done at 6% of centers.

The percentage of centers reporting ≥ 1 patients with VRE increased from 11.5% in 1995 to 34.1% in 1999 (Table 20). Among the ESRD networks, reporting of VRE varied from 14.0% (network 16) to 62.1% (network 1; Table 21).

The data reported here on treatment of VRE patients are limited in that the survey does not distinguish between clinical infection and colonization (i.e., positive culture for the organism without invasive infection). Centers that perform surveillance for VRE with stool or rectal cultures, or that treat patients from hospitals where such culturing is done, would be more likely to report VRE-colonized patients, introducing “surveillance bias.”

Table 20. Reporting of One or More Patients with Vancomycin-Resistant Enterococci (VRE), by Year, 1995-1999,

United States

Year	Number of Centers	Number (%) of Centers Reporting VRE Patients
1995	2,634	303 (11.5)
1996	2,801	596 (21.3)
1997	3,077	918 (29.8)
1999	3,462	1,180 (34.1)

Table 21. Reporting of One or More Patients with Vancomycin-Resistant Enterococci (VRE), by ESRD Network, 1999, United States

ESRD Network	States, Districts, or Territories	Percent of Centers Reporting VRE		Absolute Change
		1997	1999	
16	AK, ID, MT, OR, WA	20.2	14.0	-6.2
8	AL, MS, TN	14.8	17.7	2.9
7	FL	13.3	19.7	6.4
13	AR, LA, OK	14.8	20.3	5.5
6	GA, NC, SC	20.8	25.8	5.0
14	TX	20.2	29.2	9.0
17	AS, GU, HI, CA (northern)	38.4	30.1	-8.3
15	AZ, CO, NM, NV, UT, WY	28.6	35.7	7.1
11	MI, MN, ND, SD, WI	31.7	36.5	4.8
18	CA (southern)	38.2	36.6	-1.6
12	IA, KS, MO, NE	35.9	38.6	2.7
2	NY	39.6	40.3	0.7
5	DC, MD, VA, WV	29.0	42.9	13.9
3	NJ, PR	35.6	45.0	9.4
9	IN, KY, OH	33.2	45.7	12.5
4	DE, PA	56.3	47.3	-9.0
10	IL	44.3	49.5	5.2
1	CT, MA, ME, NH, RI, VT	57.7	62.1	4.4
	All	29.8	34.1	4.3

AS denotes American Samoa, GU denotes Guam.

Rows are sorted by percent reporting VRE in 1999.

Human Immunodeficiency Virus Infection

During 1985-1999, the percentage of centers that reported providing dialysis for patients with HIV infection increased from 11% to 36% (Table 22). Since a minority of centers routinely test for HIV, these figures may be underestimates. Note that the survey questions on HIV infection and AIDS were changed for the 1999 survey. In 1985-1997, the percent of patients with HIV infection was calculated as the number of patients with HIV infection who were treated at any time during the year divided by the total number of patients who were treated at any time during the year. In 1999, the percent of patients with HIV infection was calculated as the number of patients with HIV infection who were present during a one-week period in December divided by the total number of patients who were present during the same one-week period in December. Similar method was used to calculate the percent of patients with AIDS during 1985-1997 vs 1999.

Table 22. Chronic Hemodialysis Centers Reporting Patients with HIV Infection, 1985-1999, United States

Year	No. (%) of Centers Treating Patients with HIV Infection	No. (%) of Patients with HIV Infection	No. (%) of Patients with Clinical AIDS
1985	134 (11)	244 (0.3)	-
1986	238 (18)	546 (0.6)	332 (0.4)
1987	351 (24)	924 (1.0)	462 (0.5)
1988	401 (25)	1,253 (1.2)	670 (0.6)
1989	456 (26)	1,248 (1.0)	663 (0.5)
1990	493 (26)	1,533 (1.1)	739 (0.5)
1991	601 (29)	1,914 (1.2)	967 (0.6)
1992	737 (34)	2,501 (1.5)	1,126 (0.7)
1993	792 (34)	2,780 (1.5)	1,350 (0.7)
1994	914 (37)	3,144 (1.5)	1,593 (0.8)
1995	1,022 (39)	3,090 (1.4)	1,606 (0.7)
1996	1,088 (39)	3,112 (1.4)	1,512 (0.7)
1997	1,214 (39)	3,298 (1.3)	1,501 (0.6)
1999*	1,241 (36)	3,223 (1.4)	1,077 (0.5)

* Methods changed in 1999 (see text).

In 1999, 1.4% (range among the networks, 0.4%-3.1%) of patients were reported to have HIV infection and 0.5% (range among the networks, 0.1%-1.0%) to have AIDS (Table 23).

Table 23. Chronic Hemodialysis Centers Reporting Patients with HIV Infection/AIDS, by End Stage Renal Disease (ESRD) Network, 1999, United States

ESRD Network	States, Districts, or Territories	Number of Centers	Number of Patients	Percent of Patients With	
				HIV Infection	AIDS
2	NY	193	17,041	3.1	1.0
3	NJ, PR	111	10,331	2.8	1.0
5	DC, MD, VA, WV	250	14,637	3.1	0.8
7	FL	229	13,205	2.2	0.8
4	DE, PA	188	10,965	1.7	0.6
6	GA, NC, SC	325	20,418	1.7	0.6
1	CT, MA, ME, NH, RI, VT	119	8,284	1.5	0.4
8	AL, MS, TN	243	13,011	0.9	0.4
14	TX	257	18,825	0.9	0.4
17	AS, GU, HI, CA (northern)	137	11,283	1.0	0.4
10	IL	109	9,841	1.2	0.3
11	MI, MN, ND, SD, WI	256	13,401	0.7	0.3
13	AR, LA, OK	222	10,330	1.1	0.3
9	IN, KY, OH	243	15,967	0.6	0.2
12	IA, KS, MO, NE	161	7,142	0.6	0.2
18	CA (southern)	195	16,774	0.5	0.2
15	AZ, CO, NM, NV, UT, WY	141	8,235	0.3	0.1
16	AK, ID, MT, OR, WA	100	5,474	0.4	0.1
	All	3,483	225,226	1.4	0.5

AS denotes American Samoa, GU denotes Guam.

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Appendix I National Surveillance of Dialysis-Associated Diseases, 1999 For the Time Period January 1, 1999-December 31, 1999



If you did not treat chronic non-transient in-center hemodialysis patients in 1999, do not fill out this form

OMB NO.0920-0033 Exp.Date: 09/30/2002

Form with sections: (5-10) Provider Number, Name of Facility, Present Address, City, State, Zip Code, PATIENT DATA, 1. How often does your facility routinely test seronegative... 2. Which of these best describes your center's policy... 3. During 1999 did your facility offer the pneumococcal pneumonia vaccine... 4. During 1999 did your facility offer the influenza (flu) vaccine... 5. During 1999, how many of your CHRONIC, NON-TRANSIENT in-center hemodialysis PATIENTS converted from hepatitis B surface ANTIGEN... 6. How many CHRONIC, NON-TRANSIENT in-center hemodialysis PATIENTS were assigned to your center... 7. Of the patients counted in question 6, were all or almost all tested for hepatitis C antibody... 8. During December 6-11, 1999, how many of your chronic hemodialysis PATIENTS received hemodialysis through... 9. Of the patients with catheters (questions 8c and 8d above), how many are in each of the following categories...

DIALYSIS POLICIES AND PRACTICES

10. During December 6-11, 1999, how many of your hemodialysis patients were treated with these dialyzer types: (write in the number of patients)

a. High flux polysulfone (e.g. F60-F80)	(67-69) _____	e. Cellulose triacetate (e.g. BaxterCT)	(79-81) _____
b. Regenerated cellulose, cuprophane (e.g. TerumoCL-CT, AsahiAM, BaxterCF, Gambro-Lundia)	(70-72) _____	f. Hemophan (e.g. FoCUS)	(82-84) _____
c. Low flux polysulfone (e.g. F5-F8)	(73-75) _____	g. PMMA (e.g. Toray)	(85-87) _____
d. Cellulose acetate (e.g. BaxterCA110-210, AlthinMCA)	(76-78) _____	h. Other (specify) _____	(88-90) _____

11. In 1999, did your facility reuse dialyzers for some or all patients? (91) 1 Yes 2 No

If Yes:

11a. What method is used to disinfect the majority of these dialyzers? (CHOOSE ONE) (92-93)

1 <input type="checkbox"/> Formaldehyde (formalin)	2 <input type="checkbox"/> Glutaraldehyde (Diacide)
3 <input type="checkbox"/> Peracetic acid (e.g., Renalin, and others)	4 <input type="checkbox"/> Heat
5 <input type="checkbox"/> Amuchina	6 <input type="checkbox"/> Other (SPECIFY) _____

11b. Is bleach also used to clean the inside of these dialyzers? (94) 1 Yes 2 No

11c. Does your facility's policy allow dialyzer reuse on patients who are positive for hepatitis C antibody (anti-HCV)? (95-96) 1 Yes 2 No 3 Do not have any known anti-HCV positive patients

(Note: CDC guidelines permit dialyzer reuse for hepatitis C antibody-positive patients.)

12. At your center, where are medications from multidose vials most commonly drawn into syringes to prepare for patient administration? (CHOOSE ONLY ONE)

1 In a separate medication room or in a medication area separate from the dialysis stations (97-98)

2 At the dialysis stations

3 On a medication cart which is wheeled from patient dialysis station to dialysis station

DISEASES OR COMPLICATIONS

13. During the year 1999, how many of your hemodialysis patients were known to have a positive culture for vancomycin-resistant enterococcus (VRE)? (99) 0 None 1 1-4 2 5-9 3 \$10

13a. If you treated VRE-positive patients, do you treat them in a room separate from VRE-negative patients? (100) 0 Never 1 Sometimes 2 Always

14. During 1999 did you perform rectal swabs or stool cultures on some patients to check for VRE at your center? (Do not include cultures done while a patient was hospitalized) (101) 1 Yes 2 No

15. During the year 1999 did any of your hemodialysis patients have a positive culture for methicillin-resistant *Staphylococcus aureus* (MRSA)? (102) 1 Yes 2 No

16. How many hemodialysis patients were treated with IV vancomycin during the **MONTH** of December 1999? (Write in number of patients treated, NOT number of doses of vancomycin) (103-105) _____

17. At your center, has there been an attempt to insure that antibiotics are used appropriately? (106) 1 Yes 2 No

If Yes, circle all measures that have been implemented: (107-112)

1 <input type="checkbox"/> A written policy on antibiotic use	2 <input type="checkbox"/> Reason for antibiotic must be recorded in chart or on order form
3 <input type="checkbox"/> Automatic stop order (antibiotic must be reordered at intervals)	4 <input type="checkbox"/> Approval needed for use of certain antibiotics
5 <input type="checkbox"/> Formulary restriction (only selected antibiotics are available)	6 <input type="checkbox"/> Other, specify _____

18. Among the chronic hemodialysis patients assigned to your center as of December 6-11, 1999, how many were known positive for HIV antibody? *Include only chronic in-center hemodialysis patients* (113-115) _____

18a. Of these HIV antibody positive patients, how many were known to have AIDS? (116-118) _____

STAFF MEMBERS

19. How many full-time and part-time staff were employed in your facility the week of December 6-11, 1999? *Include only staff who had direct contact with hemodialysis patients or equipment* (119-121) _____

19a. How many of these staff had ever in their lives received at least 3 doses of hepatitis B vaccine? (122-124) _____

19b. Were all or almost all of these staff tested for hepatitis C antibody (anti-HCV) during 1999? (125) 1 Yes 2 No

(Note-this is not hepatitis B core antibody)

19b1) If Yes, how many were positive for hepatitis C antibody? (126-128) _____

Comments:

NAME OF PERSON WHO COMPLETED THIS SURVEY

Please PRINT: LAST NAME (129-139) FIRST NAME (140-150)

Phone: (_____) _____ - _____ Fax: (_____) _____ - _____

(151-160) (161-170)

Send Copy 1 of the completed form to your ESRD Network office. Keep Copy 2 for your own records. DO NOT SEND FORM TO CDC.

Call Elaine Miller (404-639-6422) with questions. Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Appendix II
Recommended Infection Control Practices for Hemodialysis Units

Infection control precautions for all hemodialysis patients (A1)

- Wear disposable gloves when caring for the patient or touching the patient's equipment at the dialysis station; remove gloves and wash hands between each patient or station.
- Items taken into the dialysis station should either be disposed of, dedicated for use only on a single patient, or cleaned and disinfected before taken to a common clean area or used on another patient.
 - Nondisposable items that cannot be cleaned and disinfected (e.g., adhesive tape, cloth-covered blood pressure cuffs) should be dedicated for use only on a single patient.
 - Unused medications (including multiple dose vials containing diluents) or supplies (syringes, alcohol swabs, etc.) taken to the patient's station should be used only for that patient and should not be returned to a common clean area or used on other patients.
- When multiple dose medication vials are used (including those containing diluents), prepare individual patient doses in a clean (centralized) area away from dialysis stations and deliver separately to each patient. Do not carry multiple dose medication vials from station to station.
- Do not use common medication carts to deliver medications to patients. Do not carry medication vials, syringes, alcohol swabs or supplies in pockets. If trays are used to deliver medications to individual patients, they must be cleaned between patients.
- Clean areas should be clearly designated for the preparation, handling and storage of medications and unused supplies and equipment. Clean areas should be clearly separated from contaminated areas where used supplies and equipment are handled. Do not handle and store medications or clean supplies in the same or an adjacent area to that where used equipment or blood samples are handled.
- Use external venous and arterial pressure transducer filters/protectors for each patient treatment to prevent blood contamination of the dialysis machines' pressure monitors. Change filters/protectors between each patient treatment, and do not reuse them. Internal transducer filters do not need to be changed routinely between patients.

- Clean and disinfect the dialysis station (chairs, beds, tables, machines, etc.) between patients.
 - Give special attention to cleaning control panels on the dialysis machines and other surfaces that are frequently touched and potentially contaminated with patients' blood.
 - Discard all fluid and clean and disinfect all surfaces and containers associated with the prime waste (including buckets attached to the machines).
- For dialyzers and blood tubing that will be reprocessed, cap dialyzer ports and clamp tubing. Place used dialyzer and tubing in a leak-proof container for transport from station to reprocessing or disposal area

Hepatitis B vaccination (A1, A2)

- Vaccinate all susceptible patients against hepatitis B.
- Test for anti-HBs 1-2 months after last dose
 - if anti-HBs <10 mIU/mL, consider susceptible, revaccinate with an additional three doses, and retest for anti-HBs;
 - if anti-HBs \geq 10 mIU/mL, consider immune and retest annually give booster dose of vaccine if anti-HBs <10 mIU/mL and continue to retest annually.

Management of HBsAg-positive patients (A1)

- Infection control practices for hemodialysis units for all patients.
- Dialyze HBsAg-positive patients in a separate room using separate machines, equipment, instruments, and supplies.
- Staff members caring for HBsAg-positive patients should not care for HBV susceptible patients at the same time (e.g., during the same shift or during patient change-over).

Routine serologic testing for hepatitis B virus (HBV) and hepatitis C virus (HCV) (A1)

Patient Status	On Admission	Monthly	Semi-Annual	Annual
All patients	HBsAg*, Anti-HBc (total) Anti-HBs, Anti-HCV, ALT			
HBV susceptible, including non-responders to vaccine		HBsAg		
Anti-HBs positive (≥ 10 mIU/mL), anti-HBc negative				Anti-HBs
Anti-HBs and anti-HBc positive		No additional HBV testing needed		
Anti-HCV negative		ALT	Anti-HCV	
* Results of HBsAg testing should be known before the patient begins dialysis.				

Other infection control topics

- Guidelines for vascular access use and preventing access-associated infections (A3, A4).
- Chronic hemodialysis patients should receive pneumococcal vaccine every 5 years and influenza vaccine every year (A5).
- Recommendations for prudent vancomycin use have been made by CDC and the Hospital Infection Control Practices Advisory Committee (A6). Cefazolin, a first-generation cephalosporin, may be substituted for vancomycin in some instances (A7).

References

- A1. Centers for Disease Control and Prevention. Recommendations for preventing transmission of infections among chronic hemodialysis patients. *Mor Mortal Wkly Rep.* 2001;In press.
- A2. Centers for Disease Control and Prevention. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination. Recommendations of the Immunization Practices Advisory Committee (ACIP). *Mor Mortal Wkly Rep.* 1991;40 (No. RR-13):1-25.
- A3. National Kidney Foundation. Dialysis outcomes quality initiative. Clinical practice guidelines. *Am J Kidney Dis.* 1997;30:S137-S240
- A4. Pearson ML, The Hospital Infection Control Practices Advisory Committee. Guideline for prevention of intravascular device-related infections. *Am J Infect Control.* 1996;24:262-293.
- A5. Rangel M, Coronado V, Euler G, Strikas R. Vaccine recommendations for patients on chronic dialysis. *Semin Dial.* 2000;13:101-107.
- A6. Centers for Disease Control and Prevention. Recommendations for preventing the spread of vancomycin resistance. *Mor Mortal Wkly Rep.* 1995;44 (No. RR-12):1-13.
- A7. Tokars JJ. Vancomycin use and antimicrobial resistance in hemodialysis centers. *Am J Kidney Dis.* 1998;521-523.

Appendix III

DIALYSIS SURVEILLANCE NETWORK

The Dialysis Surveillance Network (DSN), a voluntary national surveillance system monitoring bacterial infections and related events in hemodialysis patients, was initiated by CDC in August 1999. Both adult and pediatric dialysis centers treating outpatients are invited to participate.

Bacterial infections, especially those involving the vascular access site, cause considerable morbidity and mortality in hemodialysis patients. Due to frequent hospitalizations and receipt of antimicrobials, these patients are at high risk for infection or colonization with antimicrobial-resistant bacteria. However, there are few recent studies of bacterial infections in hemodialysis patients, and previously there were no standardized surveillance methods.

The purposes of the DSN are as follows:

1. To provide a method for individual hemodialysis centers to record and track rates of vascular access infections, other bacterial infections, and intravenous antimicrobial starts.
2. To provide rates for comparisons among various dialysis centers (benchmarking).
3. To use these data to motivate practice changes and to prevent infections, especially those caused by antimicrobial resistant organisms.

Participating centers may enter data on paper forms provided by CDC and receive a data analysis report every quarter. Alternatively, they may use our **Internet-based** system for data entry and analysis and generate and print reports whenever desired. While summary data are released, the data from individual centers are confidential and cannot be released to anyone other than the dialysis center reporting the data.

Unique features of the DSN include:

- User-friendly methods simplify reporting.
- Data collectors record the presence or absence of criteria for infections, not the infections themselves.
- A computer algorithm determines whether the infection case definitions are met.
- The data collector does not have to memorize case definitions.
- The frequency of blood culturing, a factor that may influence reported infection rates, is determined.
- Several different rates are reported to better characterize the situation at any given center.

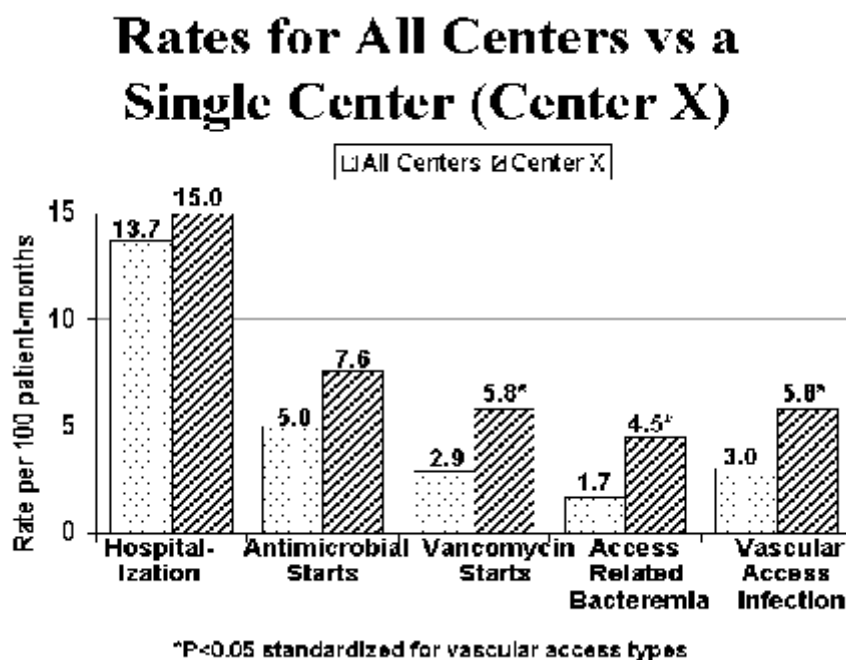
Centers are encouraged to participate in this system as a quality monitoring and control measure. **For information about enrollment, call 404-639-6422 or go to <http://www.cdc.gov/ncidod/hip/Dialysis/procedure.htm>**

SAMPLE DATA: DIALYSIS SURVEILLANCE NETWORK

The graph below shows some sample data from this surveillance system. The rates for “All Centers” are compared with the rate at a single center, designated “Center X.” Data are shown as the rate per 100-patient months, which is equivalent to the percent of patients having the stated event each month.

The five events in the graph include hospitalization, outpatient IV antimicrobial starts, outpatient IV vancomycin starts, access-related bacteremia (i.e., positive blood cultures thought to be related to the patient’s vascular access device), and vascular access infection (i.e., includes episodes both with and without a positive blood culture).

As indicated by the asterisk (*), “Center X” has some rates that are significantly higher than other centers. This was determined after standardizing the data, i.e., accounting for any possible differences in the mix of vascular access types between Center X and other centers¹. We hope that these comparisons will assist dialysis centers in their attempts to reduce infections, use antimicrobials wisely, and limit the spread of antimicrobial resistance.



¹Infection rates vary widely depending on the type of vascular access. For example, the rate of access-related bacteremia was 0.22 per 100 patient-months for fistulas, 0.48 for grafts, 5.25 for noncuffed catheters, and 8.85 for cuffed catheters