

## National Surveillance of Dialysis-Associated Diseases in the United States, 2002

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### ABSTRACT

In December 2002, all U.S. chronic hemodialysis centers were surveyed regarding selected patient care practices and dialysis-associated diseases. The results were compared with similar surveys conducted in previous years. In 2002, 85% of hemodialysis centers were free-standing and 81% operated for profit; the proportion of centers operating for profit has increased each year since 1985. During 1995–2002, the percentage of patients who received dialysis through central catheters increased from 13% to 26%; this trend is worrisome, as infections and antimicrobial use are higher among patients receiving dialysis through catheters. However, during the same period, the percentage of patients receiving dialysis through fistulas increased from 22% to 33%. The percentage of centers reporting one or more patients infected or colonized with vancomycin-resistant enterococci (VRE) increased from 12% in 1995 to 30% in 2002. During 1997–2002, the percentage of patients vaccinated against hepatitis B virus (HBV) infection increased from 47% to 56% and the percentage of staff vaccinated increased from 87% to 90%. In 2002, routine testing

for antibody to hepatitis C virus (anti-HCV) was performed on patients at 64% of centers; anti-HCV was found in 7.8% of patients. In 2001, the Centers for Disease Control (CDC) published *Recommendations for Preventing Transmission of Infections among Chronic Hemodialysis Patients*. Centers were surveyed regarding their awareness of the recommendations and about a variety of infection control practices. In general, the incidence of HBV and HCV was not substantially different for the infection control practices evaluated, including where staff obtain clean supplies for patient treatment, reuse of unused and unopened supplies, and practices for changing external transducer filters/protectors. However, in 2002, the incidence of HBV infection was higher among patients in centers where injectable medications were prepared on a medication cart or medication area located in the treatment area compared to a dedicated medication room. Also, those centers that used a disposable container versus a nondisposable container for priming the dialyzer had a significantly lower incidence of HCV.

### Background

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

of this collaboration, the response rate to the CDC questionnaire now exceeds 90%.

Since collaboration with CMS was begun, the CDC survey has been performed for calendar years 1976, 1980, 1982–1997, and 1999–2002 (2–15). 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 determine the frequency with which certain hemodialysis practices are used, including infection control practices; determine the frequency of hemodialysis-associated complications and diseases; and to 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 the CMS for calendar year 2002, the CDC distributed a questionnaire by mail to all chronic hemodialysis

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centers licensed by the CMS (previous reports available at <http://www.cdc.gov/ncidod/hip/Dialysis/dialysis.htm>).

The survey covered

Hemodialysis practices, reuse of disposable dialyzers, type of vascular access, procedures for cleaning and disinfection of dialysis equipment.

Whether patients with vancomycin-resistant enterococci (VRE) or methicillin-resistant *Staphylococcus aureus* (MRSA) were treated during 2002.

The number of patients with human immunodeficiency virus (HIV) infection.

Use of HBV vaccine in patients.

The results of testing patients for hepatitis B surface antigen (HBsAg) and antibody to hepatitis C virus (anti-HCV).

Knowledge of guidelines for prevention of HBV and HCV in the dialysis setting (16).

Selected infection control practices.

There have been changes over time in the method used to estimate the average census of patients and staff in each dialysis center. Prior to 1997, the average census was based on patients treated or staff members who worked for at least 1 month during the entire year. Beginning in 1999, the average census has been based on patients or staff members present during a 1-week period in December of the survey year (in 2002, this was December 2–7). Thus the incidence of HBV infection was defined as the number of patients who became positive for HBsAg during 2002 divided by the number of patients treated at the facility during December 2–7, 2002. The prevalence of chronic HBV infection was defined as the percentage of all patients or staff present in the facility during December 2–7, 2002, who were positive for HBsAg. The incidence of HCV infection was defined as the number of patients who became positive for anti-HCV during 2002 divided by the number of patients treated at the facility during December 2–7, 2002. The prevalence of chronic HCV infection was defined as the percentage of all patients or staff present in the facility during December 2–7, 2002, who were positive for anti-HCV. The prevalence of HIV infection and clinical acquired immunodeficiency syndrome (AIDS) was defined as the number of patients with those conditions during 2002 divided by the number of

patients treated at the facility during December 2–7, 2002.

Information on dialysis center location and ownership was obtained from the CMS End-Stage Renal Disease (ESRD) Facility Survey dataset. The results of the 2002 survey were compared to results from previous surveys. For administrative purposes, the CMS has designated 18 ESRD networks, each composed of one or more U.S. states, districts, or territories (17); to evaluate differences in practices and diseases among centers in different geographic regions, analyses were performed according to the 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. Risk factors for HCV incidence and prevalence were evaluated using Poisson regression controlling for ESRD network with indicator variables and for individual dialysis centers by using generalized estimating equations and clustering on dialysis center. All *p*-values were two-tailed; a *p*-value less than 0.05 was considered statistically significant.

## Results and Discussion

Questionnaires were returned by 4035 of 4185 centers. These 4035 centers represented 263,820 patients and 58,043 staff members (Table 1). During 1987–2002, the median number of patients per center increased from 40 to 57 and the median number of staff members per center ranged from 12 to 14 (Table 2).

During 1985–2002, the percentage of freestanding (i.e., located outside the hospital) centers increased from 56% to 85% and the percentage of centers operating for profit increased from 46% to 81% (Table 3).

### Dialyzer Reuse

The percentage of centers that reported reuse of disposable dialyzers increased from 18% to 82% during the period from 1976 to 1997, but declined slightly over the next 5 years to 63% in 2002 (Fig. 1). Of those 2465 centers that stated that they reused dialyzers, 2319 (94%) said that

TABLE 1. Summary: National Surveillance of Dialysis-Associated Diseases for selected years, 1995–2002, United States

Category	Unit of measurement	1995	1999	2001	2002
Centers responding to survey	Number of centers	2647	3483	3831	4035
Reuse dialyzers	% of centers	77	80	76	63
Total staff, all centers (end of year)	Number of staff	43,465	52,368	58,460	58,043
HBV vaccination, staff	% of staff	82	88	89	90
Total patients, all centers (end of year)	Number of patients	162,970	225,226	252,739	263,820
Vascular access					
Arteriovenous graft	% of patients	65	52	44	42
Arteriovenous fistula	% of patients	22	26	30	33
Central catheter	% of patients	13	22	25	26
HBV vaccination, patients	% of patients	35	55	60	56
Test patients for anti-HCV	% of centers	39	56	62	64
Anti-HCV prevalence, patients	% of patients	10.4	8.9	8.6	7.8
HIV infection	% of patients	1.4	1.4	1.5	1.5
AIDS	% of patients	0.7	0.5	0.4	0.4
VRE	% of centers with 1 patient	11.5	34.1	30.8	30.3
MRSA	% of centers with 1 patient	40	67	72	76

TABLE 2. Numbers of hemodialysis centers, patients, and staff members surveyed, 1985–2002, United States

Year	No. of center	Patients		Staff members	
		Total staff	Median per center	Total staff	Median per center
1985	1250	62,172	—*	20,346	—*
1986	1350	67,387	—*	21,094	—*
1987	1486	74,249	40	22,334	12
1988	1586	80,651	41	23,778	12
1989	1726	90,596	42	26,112	12
1990	1882	101,763	43	29,252	13
1991	2046	116,651	46	33,079	13
1992	2170	128,264	49	36,000	14
1993	2304	135,798	49	37,992	14
1994	2449	149,743	51	40,951	14
1995	2647	162,970	51	43,465	14
1996	2808	177,324	53	47,215	14
1997	3077	195,935	54	50,321	14
1999	3483	225,226	56	52,368	13
2000	3683	241,113	57	55,585	13
2001	3831	252,739	58	58,400	13
2002	4035	263,820	57	58,043	12

\*Data not available.

they reprocessed them at their facility, 140 (5.7%) said that they were reprocessed off site, and 6 (0.3%) said that dialyzers were reprocessed both at the facility and off site.

During 1983–2002, the percentage of centers using formaldehyde for reprocessing dialyzers decreased from 94% to 20%, while the percentage using a peracetic acid product increased from 5% to 72% (Fig. 2). In 2002, 4% of centers used heat or glutaraldehyde to disinfect dialyzers between reuses. Although dialyzer reuse has been implicated in numerous outbreaks of bacteremia and pyrogenic reactions, this practice is safe if performed according to recognized protocols (18–20).

### Vascular Access Types

The vascular access site is the most common site for infection in hemodialysis patients, and access site

infections are particularly important because they can cause disseminated bacteremia or loss of the vascular access. The primary risk factor for access infection is access type, with catheters having the highest risk for infection, grafts intermediate, and native arteriovenous fistulas (AVFs) the lowest (16).

During the survey period, 41.6% of patients received dialysis through an arteriovenous graft (AVG), 32.7% through an AVF, and 26.3% through a temporary or permanent central catheter (Table 4). Since 1995, the percentage of patients receiving dialysis through catheters increased from 12.7% to 26.3%. Among the 18 ESRD networks designated by the CMS, use of fistulas (the most desirable access type) ranged from 25.4% to 53.4% (Table 5). Use of port access devices ranged from 0.0% to 2.8%.

### VRE and MRSA

Dialysis patients have played a prominent role in the epidemic of vancomycin resistance because this drug is used commonly in these patients, in part because vancomycin can be conveniently administered to patients when they come in for hemodialysis treatments (16). The percentage of centers reporting more than one patient with VRE increased from 12% in 1995 to 34% in 1999, then decreased slightly to 30% in 2002 (Table 6). Among the ESRD networks, reporting of VRE ranged from 18.4% (network 17) to 55.2% (network 1) (Table 7).

In 2002, 69.7% of centers reported no known patients with VRE; 27.7% centers reported 1–4 patients with VRE; 2.0% centers reported 5–9 patients with VRE; and 0.6% centers reported 10 or more patients with VRE. Among centers having more than one VRE-positive patient, 16.3% of centers reported always treating VRE-positive patients in a separate room, 10.4% sometimes treated them in a separate room, and 73.2% never treated them in a separate room.

During 1995–2002, the percentage of centers reporting that they had treated one or more patients with

TABLE 3. Location and ownership of hemodialysis centers, 1985–2002, United States

Year	Location (%)			Ownership (%)	
	Hospital	Freestanding	Profit	Nonprofit	Government
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
2000	18	82	78	18	4
2001	17	83	78	18	4
2002	15	85	81	15	4

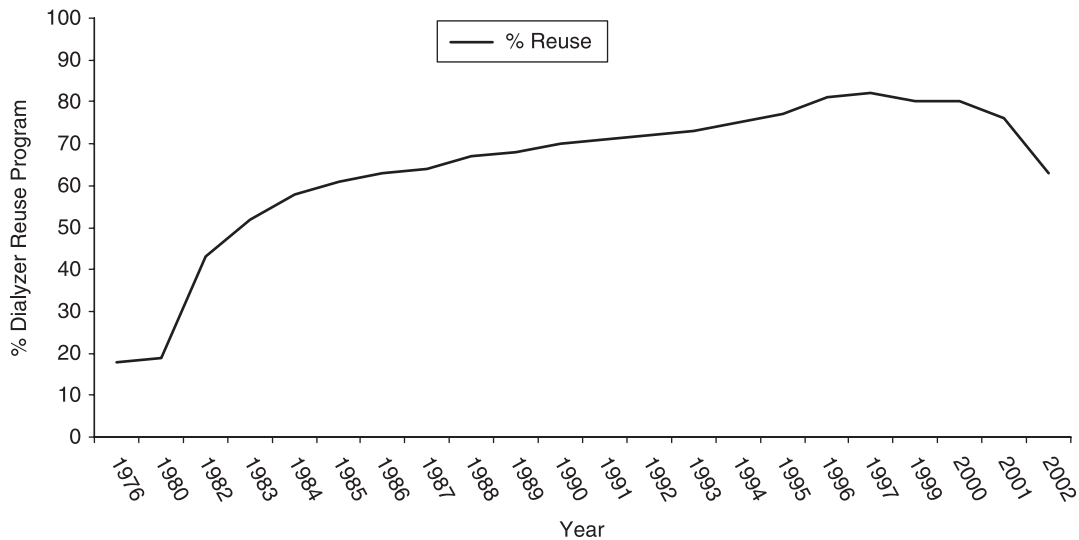


FIG. 1. Hemodialysis centers having dialyzer reuse programs, 1976–2002, United States.

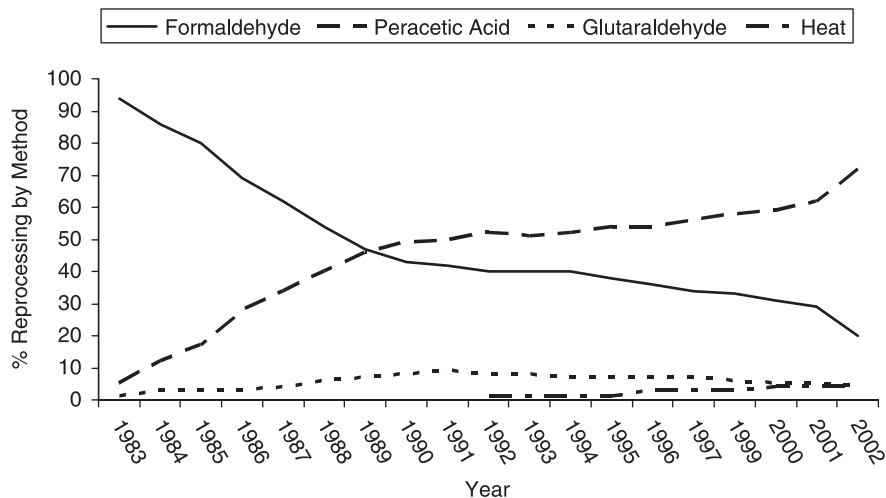


FIG. 2. Methods for reprocessing dialyzers in hemodialysis centers, 1983–2002, United States.

MRSA increased from 40% to 76% (Table 6). However, the data reported here on treatment of VRE and MRSA patients are limited, as 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 MRSA, or that treat patients from hospitals where such culturing is done, would be more likely to report colonized patients, introducing an ascertainment bias.

TABLE 4. Types of vascular access used for hemodialysis, 1995–2002, United States

Year	No. of patients	Percent of patients by type of vascular access					
		Fistula	Graft	All catheters	Tunneled catheters	Nontunneled catheters	Port
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	19.0	3.2	—*
2000	241,113	28.0	48.0	24.0	20.8	3.3	—*
2001	252,265	30.4	44.4	24.6	21.7	2.8	0.6
2002	268,033	32.7	41.6	26.3	23.2	2.4	0.7

\*Data not collected.

TABLE 5. Vascular access types by ESRD network, December 2002, United States

ESRD network	States, districts, or territories	No. of patients	Percent of patients by type of vascular access				
			Fistula	Graft	Nontunneled catheter	Tunneled catheter	Port
1	CT, MA, ME, NH, RI, VT	9363	42.0	28.3	1.6	27.3	0.6
2	NY	19,553	39.0	36.8	1.5	22.7	0.4
3	NJ, PR	11,282	34.7	34.6	5.1	25.3	0.0
4	DE, PA	11 770	32.2	36.0	2.1	29.1	0.5
5	DC, MD, VA, WV	16,118	26.9	46.6	2.7	23.3	1.0
6	GA, NC, SC	24,770	29.6	45.4	2.5	23.4	0.7
7	FL	15,765	34.8	36.0	3.1	25.2	0.4
8	AL, MS, TN	14,820	27.0	52.7	2.1	19.0	0.6
9	IN, KY, OH	18,933	29.8	36.8	1.7	29.4	0.3
10	IL	11,504	33.3	38.3	2.8	25.2	0.5
11	MI, MN, ND, SD, WI	15,601	34.8	36.0	1.9	26.6	0.9
12	IA, KS, MO, NE	9062	30.9	40.3	1.2	26.4	2.4
13	AR, LA, OK	11,427	25.4	45.3	2.8	24.4	2.8
14	TX	22,240	32.7	41.6	2.4	23.1	0.7
15	AZ, CO, NM, NV, UT, WY	11,082	39.9	34.9	2.6	23.0	0.2
16	AK, ID, MT, OR, WA	6476	53.4	30.6	0.7	20.8	0.5
17	AS, GU, HI, CA (northern)	13,337	34.8	44.2	2.3	18.4	0.3
18	CA (southern)	20,717	36.4	44.1	2.6	18.2	0.3
20	All	263,820	32.7	41.6	2.4	23.2	0.7

AS, American Samoa; GU, Guam.

## HIV Infection

Although the proportion of patients with HIV infection has remained fairly stable during the past decade, the number of infected patients has increased, as has the number of centers treating patients with HIV infection (Table 8). However, since a minority of centers routinely tests for HIV, these figures may be underestimates. In 2002, 1.5% (range among the networks, 0.3–1.5%) of patients were reported to have HIV infection and 0.4% (range among the networks 0.4–0.8%) of patients were reported to have AIDS (Table 9).

## Use of HBV Vaccine

Hepatitis B vaccination has been recommended for chronic hemodialysis patients and staff since 1982. During 1983–2002, the percentage that had ever received at least three doses of HBV vaccine increased from 5.4% to 56% among patients and from 26.1% to 90% among staff (Fig. 3). The proportion of patients vaccinated in 2002 was slightly lower than in 2001 (59.8%) (Table 10). This decline could be real or could reflect minor fluctuations around a point estimate; however, vaccination coverage among patients should be monitored in the future.

TABLE 6. Reporting of one or more patients with VRE or MRSA, by year, 1995–2002, United States

Year	No. of centers reporting VRE patients/total centers (%)	No. of centers reporting MRSA patients/total centers (%)
1995	303/2634 (12)	1056/2620 (40)
1996	596/2801 (21)	1354/2797 (48)
1997	918/3077 (30)	1720/3077 (56)
1999	1180/3462 (34)	2314/3454 (67)
2000	1195/3659 (33)	2562/3623 (71)
2001	1175/3814 (31)	2724/3792 (72)
2002	1194/4035 (30)	3045/3996 (76)

Among the ESRD networks, the percentage of patients who received HBV vaccination in 2002 ranged from 36.8% to 66.5% (Table 10). Most networks experienced declines in vaccination coverage among patients. The largest absolute decline in the percentage vaccinated during 2001–2002 (–13%) occurred in ESRD network 8. The largest absolute increase in the percentage vaccinated during 2001–2002 occurred in ESRD network 17.

## Incidence and Prevalence of HBV Infection

In 2002, the prevalence of HBsAg positivity among patients was 1.0%, a figure that has not changed substantially during the past decade (Fig. 4). Similarly, the incidence of HBV infection in patients also has not changed substantially during the past decade, and in 2002 was 0.12% (Fig. 4).

In 2002, 27.3% of centers reported one or more patients with chronic (prevalent) HBV infection and 2.8% of centers reported one or more patients with newly acquired (incident) HBV infection. Although the incidence and prevalence of HBV infection among hemodialysis patients have declined dramatically, patients still acquire HBV infection from community sources or from transmission in hemodialysis centers due to inadequate infection control precautions (21–23) and accidental breaks in technique (24). Factors contributing to the decline in HBV infection since the 1970s as well as ongoing transmission have been reviewed elsewhere (10,16).

## Incidence and Prevalence of HCV Infection

In 2001, routine testing of hemodialysis patients for anti-HCV on admission and every 6 months was recommended (16). In 2002, 63% of centers tested patients for anti-HCV and 11.5% reported having at least one patient who became anti-HCV positive in 2002 (i.e., tested positive for anti-HCV in 2002 but had previously tested

TABLE 7. Reporting of one or more patients with VRE, by ESRD network, 2001–2002, United States

ESRD network	States, districts, or territories	Percent of centers reporting VRE		Absolute change
		2001	2002	
1	CT, MA, ME, NH, RI, VT	64.0	55.2	-8.8
2	NY	35.7	37.7	2.0
3	NJ, PR	26.1	32.0	5.9
4	DE, PA	41.0	36.2	-4.8
5	DC, MD, VA, WV	37.4	35.0	-2.4
6	GA, NC, SC	26.2	26.5	0.3
7	FL	21.2	24.6	3.4
8	AL, MS, TN	21.8	19.6	-2.2
9	IN, KY, OH	40.9	39.6	-1.3
10	IL	38.0	36.7	-1.3
11	MI, MN, ND, SD, WI	35.1	35.0	-0.1
12	IA, KS, MO, NE	34.4	30.7	-3.7
13	AR, LA, OK	20.7	19.3	-1.4
14	TX	27.0	31.5	4.5
15	AZ, CO, NM, NV, UT, WY	30.1	28.7	-1.4
16	AK, ID, MT, OR, WA	16.2	18.9	2.7
17	AS, GU, HI, CA (northern)	25.2	18.4	-6.8
18	CA (southern)	25.4	23.2	-2.2
	All	30.8	30.3	-0.5

AS, American Samoa; GU, Guam.

negative); the incidence rate in 2002 was 0.34%. In 2001, the incidence rate was similar at 0.29%.

Among centers that tested for anti-HCV, the prevalence of anti-HCV among patients was 7.8%, a decrease of 25.7% since 1995 (Table 1 and Fig. 5). Patient anti-HCV prevalence among the ESRD networks ranged from 5.5% to 9.8% (Table 11). There were no significant differences in HCV incidence or prevalence in centers that reused dialyzers compared to those who did not reuse dialyzers (Table 12). HCV transmission has occurred in facilities where there were multiple opportunities for cross-contamination among patients, including failure to clean and disinfect contaminated equipment, supplies, and environmental surfaces that were shared between patients (16). However, the decline in prevalence may be attributable in part to a decline in new infections among patients as a result of increased

awareness of the potential for HCV transmission in this setting.

### Infection Control Recommendations and Practices

In 2001, the CDC published *Recommendations for Preventing Transmission of Infections among Chronic Hemodialysis Patients* (16). Centers were surveyed regarding their awareness of the recommendations and whether they had a copy of the recommendations at their center. Almost 90% of centers (3565/3972) stated that they were aware of the recommendations, and 84% of these had a copy of the recommendations on site. Of those that were aware of the recommendations, 55% stated that changes were made to the facility's infection control practices as a result of reading the recommendations.

TABLE 8. Chronic hemodialysis centers reporting patients with HIV infection, 1985–2002, 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)	1253 (1.2)	670 (0.6)
1989	456 (26)	1248 (1.0)	663 (0.5)
1990	493 (26)	1533 (1.1)	739 (0.5)
1991	601 (29)	1914 (1.2)	967 (0.6)
1992	737 (34)	2501 (1.5)	1126 (0.7)
1993	792 (34)	2780 (1.5)	1350 (0.7)
1994	914 (37)	3144 (1.5)	1593 (0.8)
1995	1022 (39)	3090 (1.4)	1606 (0.7)
1996	1088 (39)	3112 (1.4)	1512 (0.7)
1997	1214 (39)	3298 (1.3)	1501 (0.6)
1999*	1241 (36)	3223 (1.4)	1077 (0.5)
2000	1352 (37)	3447 (1.5)	893 (0.4)
2001	1434 (37)	3822 (1.5)	968 (0.4)
2002	1556 (39)	4019 (1.5)	1055 (0.4)

TABLE 9. Chronic hemodialysis centers reporting patients with HIV infection/AIDS, by ESRD network, 2002, United States

ESRD network	States, districts, or territories	Percent of patients			
		No. of centers	No. of patients	HIV infection	AIDS
1	CT, MA, ME, NH, RI, VT	135	9363	1.6	0.4
2	NY	231	19,553	3.3	1.0
3	NJ, PR	130	11,282	2.5	0.8
4	DE, PA	217	11,770	1.6	0.4
5	DC, MD, VA, WV	269	16,118	3.4	0.5
6	GA, NC, SC	420	25,168	2.1	0.6
7	FL	254	15,765	2.8	0.6
8	AL, MS, TN	273	14,290	1.2	0.4
9	IN, KY, OH	288	18,933	0.5	0.2
10	IL	142	11,504	1.4	0.3
11	MI, MN, ND, SD, WI	293	15,601	0.8	0.4
12	IA, KS, MO, NE	195	9062	0.7	0.2
13	AR, LA, OK	240	11,427	1.1	0.3
14	TX	293	22,240	1.0	0.3
15	AZ, CO, NM, NV, UT, WY	193	11,082	0.4	0.1
16	AK, ID, MT, OR, WA	111	6476	0.3	0.1
17	AS, GU, HI, CA (northern)	142	13,337	0.7	0.2
18	CA (southern)	216	20,717	0.7	0.2
	All	4035	263,820	1.5	0.4

AS, American Samoa; GU, Guam.

### Preparation of Injectable Medications

In 2002, 52.8% of centers reported that medications from multidose vials were drawn into syringes in preparation for patient administration in a dedicated medication room or an area separate from the treatment area, 24.6% reported that medications were prepared on a medication cart or a medication area within the treatment area, 3.7% at the dialysis station, and 18.9% in other areas. In 2002, the incidence of HBV infection was significantly higher among patients in centers where injectable medications were prepared on a medication cart or medication area located in the treatment area compared to a dedicated medication room (Table 13). However, the incidence of HCV infection was not significantly different by location where injectable medications were prepared.

The incidence of HBV results are of particular concern because all medications, supplies, and equipment

for HBsAg-positive patients should be dedicated for their use and not used by HBV-susceptible patients. Outbreaks of HBV infection have occurred when multiple-dose medication vials were available in the treatment area and used for both infected and susceptible patients, although isolation procedures for HBsAg-positive patients were in place for equipment and other supplies (24). To avoid contamination in the general hemodialysis population, medications should be prepared in a centralized area separate from the treatment area, and supplies and equipment should be shared only if they are disinfected between patients (16).

### Handling of Supplies at the Dialysis Center

The CDC recommends that clean supplies be stored in a room or area separate from the treatment area. If a common supply cart is used to store clean supplies in the



FIG. 3. Use of HBV vaccine in hemodialysis centers, 1983–2002, United States.

TABLE 10. Use of HBV vaccine in hemodialysis patients by ESRD network, 2001–2002, United States

ESRD network	States, districts, or territories	Percent vaccinated		Absolute change
		2001	2002	
1	CT, MA, ME, NH, RI, VT	59.4	57.4	-2.0
2	NY	45.8	39.0	-6.8
3	NJ, PR	51.4	48.9	-2.5
4	DE, PA	61.8	60.7	-1.1
5	DC, MD, VA, WV	58.3	56.8	-1.5
6	GA, NC, SC	64.5	57.2	-7.3
7	FL	60.2	58.9	-1.3
8	AL, MS, TN	66.9	53.9	-13.0
9	IN, KY, OH	57.0	51.8	-5.2
10	IL	42.8	36.8	-6.0
11	MI, MN, ND, SD, WI	63.1	54.7	-8.4
12	IA, KS, MO, NE	69.5	58.3	-11.2
13	AR, LA, OK	61.4	60.2	-1.2
14	TX	65.8	66.1	0.3
15	AZ, CO, NM, NV, UT, WY	60.9	61.8	0.9
16	AK, ID, MT, OR, WA	65.5	66.5	1.0
17	AS, GU, HI, CA (northern)	58.0	62.1	4.1
18	CA (southern)	61.9	59.5	-2.4
	All	59.8	56.0	-3.8

AS, American Samoa; GU, Guam.

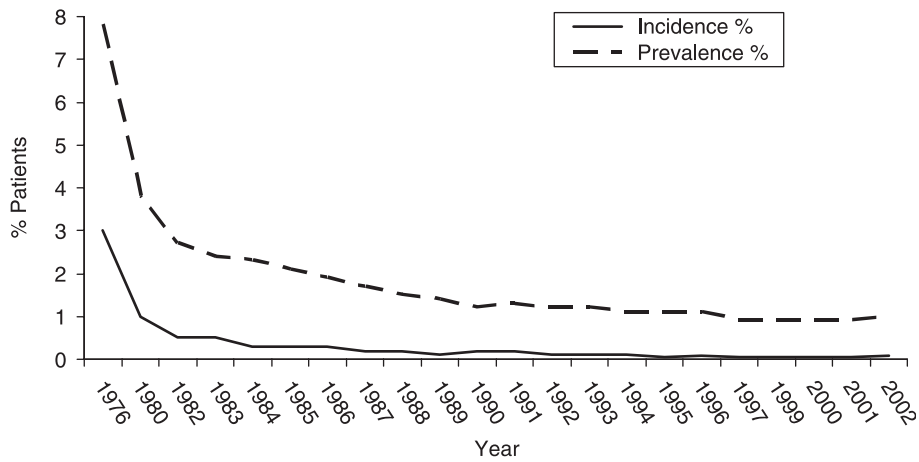


Fig. 4. Incidence and prevalence of HBV infection in hemodialysis patients, 1976–2002, United States.

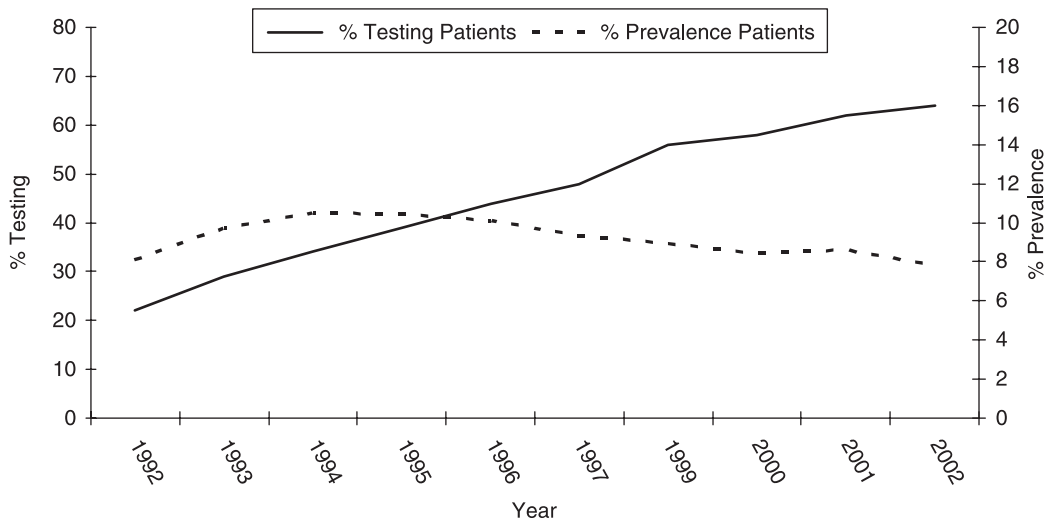


Fig. 5. Antibody to HCV testing and prevalence among hemodialysis patients, 1992–2002, United States.



**TABLE 11. Prevalence of anti-HCV among hemodialysis patients by ESRD network, 2002, United States**

ESRD network	States, districts, or territories	Percent of centers testing	Total tested	Anti-HCV positive
1	CT, MA, ME, NH, RI, VT	79	7549	5.8
2	NY	69	14,489	9.4
3	NJ, PR	80	8439	9.8
4	DE, PA	71	7887	7.8
5	DC, MD, VA, WV	67	10,755	9.2
6	GA, NC, SC	62	15,645	6.9
7	FL	65	10,489	6.5
8	AL, MS, TN	60	8461	7.6
9	IN, KY, OH	52	9218	6.7
10	IL	63	6869	8.5
11	MI, MN, ND, SD, WI	60	9263	7.6
12	IA, KS, MO, NE	51	5012	6.1
13	AR, LA, OK	67	7568	9.2
14	TX	66	14,462	9.5
15	AZ, CO, NM, NV, UT, WY	50	5265	6.8
16	AK, ID, MT, OR, WA	50	2709	5.5
17	AS, GU, HI, CA (northern)	68	8607	7.0
18	CA (southern)	64	11,945	7.3
	All	63	164,632	7.8

AS, American Samoa; GU, Guam.

**TABLE 12. Incidence and prevalence of anti-HCV among hemodialysis patients by dialyzer reuse practice, 2002, United States**

	Anti-HCV Prevalence			Anti-HCV incidence <sup>a</sup>		
	Centers	No. (%)	<i>p</i> -value*	Centers	No. (%)	<i>p</i> -value*
Reuse dialyzers						
No	1117	5115 (8.1)		857	169 (0.31)	
Yes	1390	7788 (7.9)	0.9	1187	322 (0.36)	0.3

<sup>a</sup>Analysis limited to centers that test for anti-HCV and have at least one prevalent case of HCV infection.

\**p*-values determined by Poisson regression, controlling for ESRD network and dialysis unit.

patient treatment area, this cart should remain stationary in a designated area at a sufficient distance from patient stations to avoid contamination with blood (16). The majority (61%) of respondents stated that staff obtain clean supplies for patient treatment from a common supply cart within the treatment area, 26% stated that staff obtain clean supplies from a room or area separate from the treatment area, and 13% stated that staff obtain supplies from some other place.

The CDC also recommends that any item taken to a patient's dialysis station should be disposed of, dedicated for use only on a single patient, or cleaned and disinfected before being returned to a common clean area or used for

other patients. The majority (77%) of respondents stated that staff discard unused supplies (adhesive tape, unopened packets of needles and syringes) remaining at the dialysis station when a patient finishes treatment, 10% said that they return supplies to a common supply cart to be used on another patient, 6% said that they leave unused supplies at the dialysis station for use on the next patient, and 8% said that they do something with the supplies other than those choices listed. The prevalence of HCV infection was only slightly, but significantly, higher in centers that stated they return unused supplies to a common supply cart to be used on another patient. The incidence of HCV infection did not differ by disposition of used supplies.

**TABLE 13. Place where injectable medications were prepared and association with incidence of HBV and HCV infection in patients, 2002, United States**

Place where medication drawn up into syringe	HBsAg incidence, <sup>a</sup> <i>n</i> /total (%)	Anti-HCV incidence, <sup>b</sup> <i>n</i> /total (%)
Dedicated medication room or medication preparation area separate from treatment area	29/48,210 (0.06)	230/67,638 (0.34)
Dialysis station	5/3896 (0.13)	19/5982 (0.32)
Medication cart or medication area located within the treatment area	75/28,241 (0.27)*	160/44,506 (0.36)

<sup>a</sup>Analysis limited to centers that have at least one prevalent case of HBV infection.

<sup>b</sup>Analysis limited to centers that test for anti-HCV and have at least one prevalent case of HCV infection.

\**p* < 0.05 compared with dedicated medication room or medication preparation area separate from treatment area.

**TABLE 14. Venous tubing drainage method and association with incidence of HCV infection in patients, 2002, United States**

Method of draining the venous tubing	Anti-HCV incidence, <sup>a</sup> n/total (%)
Disposable container discarded after each treatment	9/4907 (0.18)
Nondisposable container not attached to the machine	38/10,170 (0.37)
Nondisposable container attached to the machine	332/84,023 (0.39)*

<sup>a</sup>Analysis limited to centers that test for anti-HCV and have at least one prevalent case of HCV infection.

\**p* < 0.05 compared with disposable container.

### Priming the Dialyzer

Containers into which priming solution from venous tubing is drained are another potential source for cross-contamination between patients and the CDC recommends that these containers be discarded or cleaned and disinfected between patients. In 2002, the majority (62%) of centers stated that they primed the dialyzer before treatment by letting the venous tubing drain into a nondisposable container attached to the machine, 22% said that they use the waste handling option (WHO) (on Cobe machines equipped with this option), 6% said that they use a nondisposable container not attached to the machine (e.g., wastebasket), 3% said that they use a disposable container that is discarded after each patient's treatment, and 7% said that they did something other than that listed in the survey. Centers that use a disposable container that is discarded after each patient use had a significantly lower HCV incidence than those that used a nondisposable container either attached or not attached to the machine (Table 14). Of those that used nondisposable containers, 81% cleaned them after each patient, 11% at the end of day, and 3% at the end of the shift. HCV incidence was slightly higher in those centers that cleaned these nondisposable containers at the end of the day (0.46%) compared to the end of the shift (0.36%) or after each patient (0.40%), but these differences in incidence were not statistically significant.

### External Transducer Filters/Protectors

In 2002, 77% of centers stated that they used external transducer filters/protectors and 23% stated that they did not. Of these, 83% stated that they changed them after each treatment, 2% only when wet, and 15% under other conditions. Although HCV incidence was slightly higher in centers that changed the external filters/protectors only when wet (0.46%) compared to after each treatment (0.39%), these differences were not statistically significant. The CDC recommends that external transducer filters be used and that they be changed after each treatment (16).

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