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Assessments and observations of infection prevention and control practices in US outpatient hemodialysis facilities, 2015–2018: important opportunities for improvement

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Abstract

Infections cause substantial morbidity and mortality among patients receiving care in outpatient hemodialysis facilities. We describe comprehensive infection prevention assessments by US public health departments using standardized interview and observation tools. Results demonstrated how facility layouts can undermine infection prevention and that clinical practices often fall short of policies.

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Introduction

In 2021, >460,000 persons with end-stage renal disease in the United States received outpatient hemodialysis;[1] infections are a leading cause of morbidity and mortality. Implementation of Centers for Disease Control and Prevention (CDC) recommended practices in the dialysis setting have decreased bloodstream infections (BSIs) by >50% with sustained reductions.[2–4] While BSIs continue to be one of the most common infections among dialysis patients, the COVID-19 pandemic highlighted the risk for other infection types.[5,6] Outbreak investigations have identified lapses in infection prevention and control (IPC) practices and multiple IPC challenges in the outpatient dialysis setting.[7,8] Reinforcing IPC is important given patient comorbidities and their need to regularly receive lifesaving dialysis treatments.[6]

In 2015, supplemental funding was provided to US health department healthcare-associated infection and antibiotic resistance (HAI/AR) programs to assess and improve IPC in healthcare settings.[9,10] Here, we describe a large comprehensive examination of outpatient hemodialysis facility IPC practices by HAI/AR programs using standardized CDC tools.

Methods

An outpatient hemodialysis Infection Control Assessment and Response (ICAR) form was created and included questions to assess facility leadership-reported IPC practices and policies/protocols, along with direct observations of clinical IPC practices.[4] The tool comprised four sections: (1) Facility Demographics, (2) Infection Control Program and Infrastructure, (3) Direct Observation of Facility Practices, and (4) Infection Control Guidelines and Other Resources (see Supplemental Materials). Sections 1, 2, and 4 were completed during facility leadership interviews (ie, facility or nursing manager), either in-person or via telephone. Section 3 was completed by HAI/AR staff during facility visits based on direct observations of seven clinical IPC practices.[4] Facilities received written results following visits, along with actionable information to address IPC practice gaps. Not all completed assessments included Section 3.

Nine New Jersey facilities piloted the hemodialysis ICAR form in October 2015; pilot data were included in aggregate results. Funded HAI/AR programs conducted ICAR visits (convenience sample) through Spring 2018 and submitted aggregate data to CDC.

Statistical analysis

Summary frequencies were calculated to describe facility characteristics (sections 1 and 2); IPC practice observations (section 3) were summarized across domains by calculating frequencies and percentages of successful observations (hand hygiene opportunities and six procedures requiring 100% stepwise adherence), including confidence intervals. All calculations were performed using SAS 9.4 (Cary, NC).

Results

Facility characteristics

Between March 31, 2015, and March 30, 2018, 34 HAI/AR programs (30 states, 2 cities, and 2 territories) completed 800 outpatient hemodialysis facility ICAR visits (average 23 facilities/jurisdiction, range 1–85) (see Figure in Supplemental Materials). Most facilities cared for ≤75 patients (56%), were not hospital-affiliated (82%), and belonged to a large dialysis organization (87%), most commonly DaVita Inc (32%) and Fresenius Kidney Care (46%).

Infection control program and infrastructure responses

Figure 1 shows Section 2 assessment responses. Facilities reported having someone with IPC training at the facility (78%), but only 5% had staff with certification in infection control. Many facilities had dialysis treatment stations spaced <3 feet apart (23%) or had shared, embedded computer charting terminals (38%). Approximately half (46%) had no isolation room available for conditions other than hepatitis B. Over one-third (36%) lacked ability to separate ill patients (eg, exhibiting respiratory symptoms) from other patients by ≥6 feet. Separate medication preparation rooms were not common (40%).

Regarding environmental cleaning and disinfection practices, >95% reported having policies and procedures in place. Job-specific environmental cleaning and disinfection training was reported by 92%, while 88% indicated they routinely audited staff practices.

Regarding catheter and other vascular access care practices, >90% of facilities reported training staff on recommended practices (eg, “scrub-the-hub”). Ninety-four percent reported observing staff catheter care practices at least quarterly, and 95% provided feedback to clinical staff.

Direct observation of facility practices

In total, 70,288 standardized observations of seven IPC practices were collected during 764 (95.5%) ICAR visits (Figure 2). Of 42,642 hand hygiene opportunities observed, 38,169 were successful (89.5%; CI 89.2–89.8). In descending order, adherence to recommended practices for the other observations were injectable medication administration (87.3%; CI 86.1–88.3), injectable medication preparation (82.1%; CI 80.9–83.3), catheter connection and disconnection (82.0%; CI 80.8–83.2), arteriovenous fistula/graft cannulation (77.3%; 76.3–78.3), catheter exit site care (65.8%; CI 63.9–67.7), and routine disinfection of the dialysis station (62.4%; CI 61.2–63.5).

Discussion

CDC-funded health department HAI/AR programs developed and expanded hemodialysis IPC capacities by visiting approximately 11% of US outpatient hemodialysis facilities during the project period and identifying specific areas for improvement. Our data revealed an IPC policy-to-practice disconnect particularly for environmental cleaning and catheter care. Additionally, our findings demonstrate the facility layout frequently impedes staff’s ability to adhere to recommended IPC practices.

Despite facility leadership reporting strong infection prevention infrastructure through the existence of policies/procedures, identified staff responsible for IPC, trainings, and auditing of staff practices, HAI/AR staff documented substantial clinical practice weaknesses when performing observations using standardized tools. The largest discrepancy concerned environmental cleaning practices. Direct observations of routine disinfection of the dialysis station recorded 62% adherence with all CDC-recommended steps. The same discrepant pattern appeared when comparing facilities' reported vascular access care practices with observed practices, which revealed 66% catheter exit site care adherence, 77% for arteriovenous fistula/graft cannulation, and 82% for catheter connection and disconnection. These discrepant policy-to-practice findings highlight a need for re-examination of facility policies and observations, coupled with external collaboration with HAI/AR program staff or others to independently assess IPC practices of clinical staff.

The clinical environment, in addition to factors such as staffing ratios and closely staggered patient treatment times, can impede the ability of staff to adhere to policies/procedures. Ongoing work to ensure the environment of care in an outpatient dialysis facility enables adherence to IPC practices is critical. An example includes considering alternatives to shared computer charting terminals between dialysis stations due to potential cross-contamination and cleaning/disinfection challenges.

Our findings are subject to several limitations. Despite nationwide scope and large sample size, facility selection was nonrandom and determined by each jurisdiction. However, participation percentages closely matched national figures. Documentation of standardized IPC observation steps may have differed due to varying levels of observer experience in this setting. Additionally, adherence to procedural observation steps was not analyzed in detail because only aggregated data were available to summarize. For example, 13% of injectable medication administration observations had some deficiency which could result in patient harm, but we were unable to pinpoint the missed IPC step(s), and severity of missed practices. Finally, we were unable to evaluate the impact of the ICAR program on facility IPC practices.

The COVID-19 pandemic added incredible strain to IPC practices of outpatient hemodialysis facilities, requiring rapid modifications to procedures.[8] However, our results demonstrate that gaps in prepandemic IPC practices and layout of the care environment may have hampered facility readiness. Evaluating and improving facility design, increasing staff IPC competency, and improving IPC observations and feedback will advance patient and staff safety. This project, along with continued CDC funding for HAI/AR programs, has expanded health department dialysis IPC capacity. Participating facilities provided positive feedback to HAI/AR programs related to IPC knowledge sharing following assessments. Future actions should encourage increased hemodialysis facility and HAI/AR program collaboration, understanding of specific IPC procedural steps to target for improvement in this setting, including adherence barriers, and strategies to support improved implementation. Improvement of routine IPC practices and public health collaboration may lessen the impact of future emerging infections.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Disclaimer.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. The authors acknowledge the HAI/AR program staff from participating states, cities, and territories.

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Competing interests.

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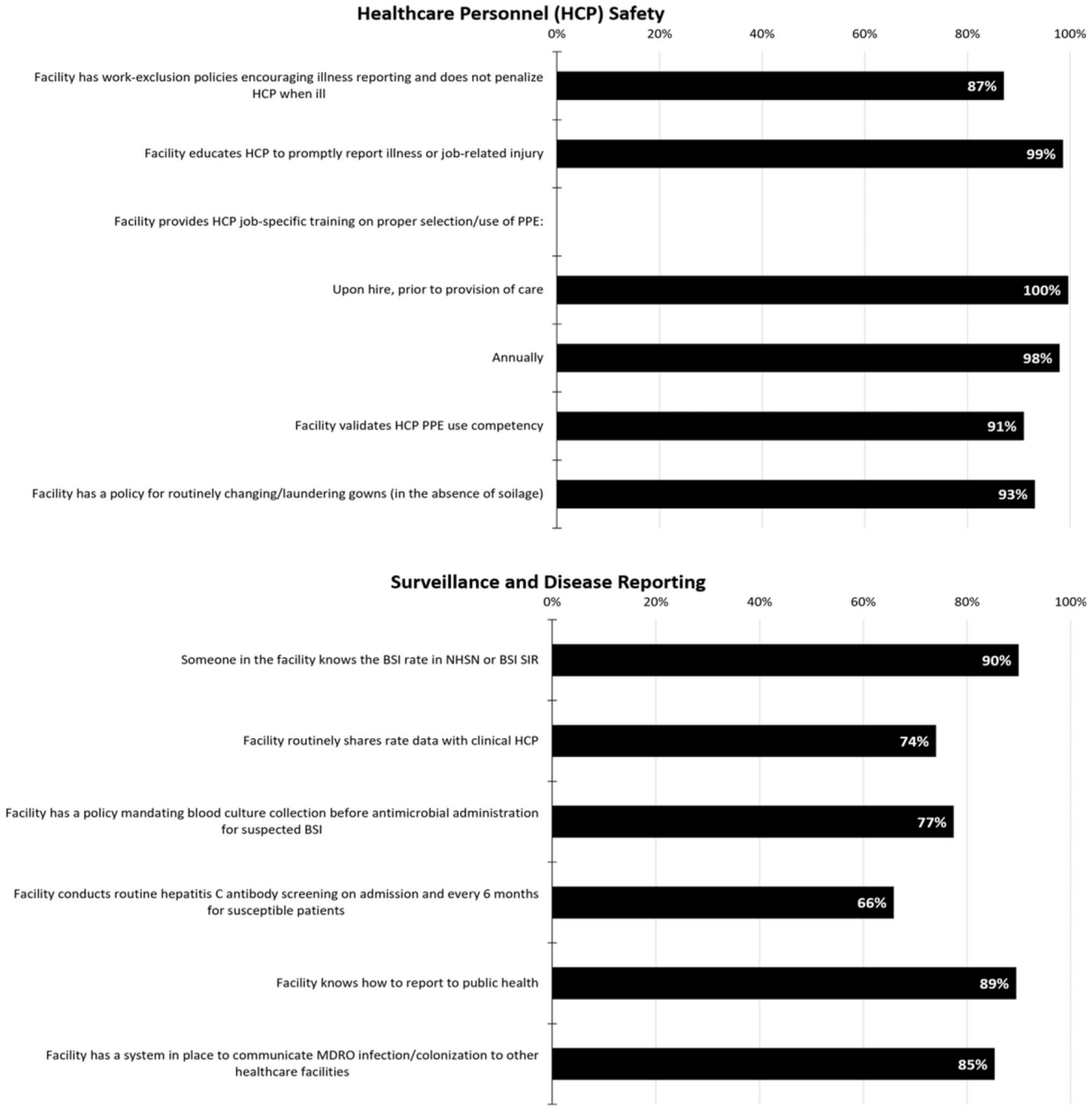

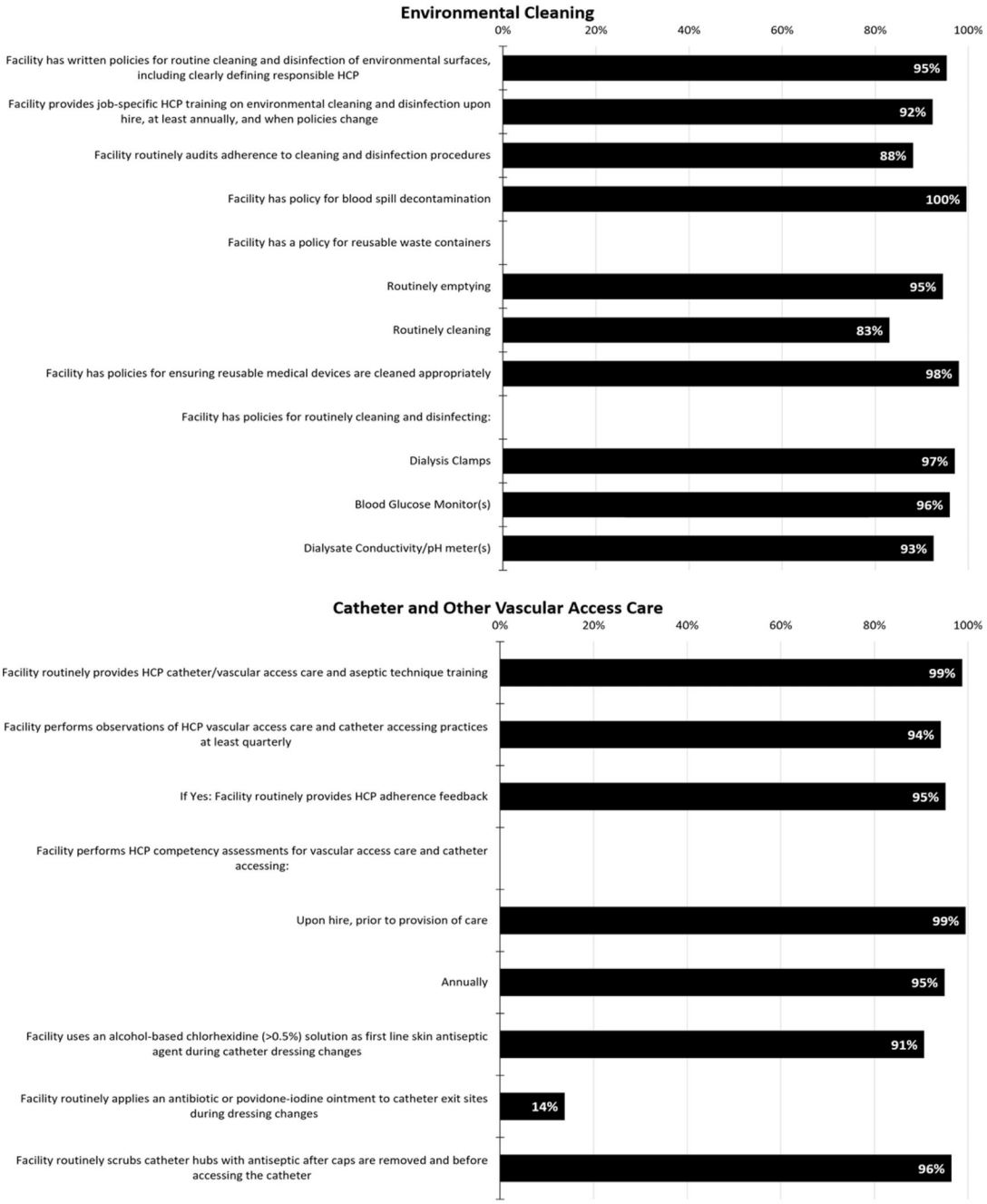

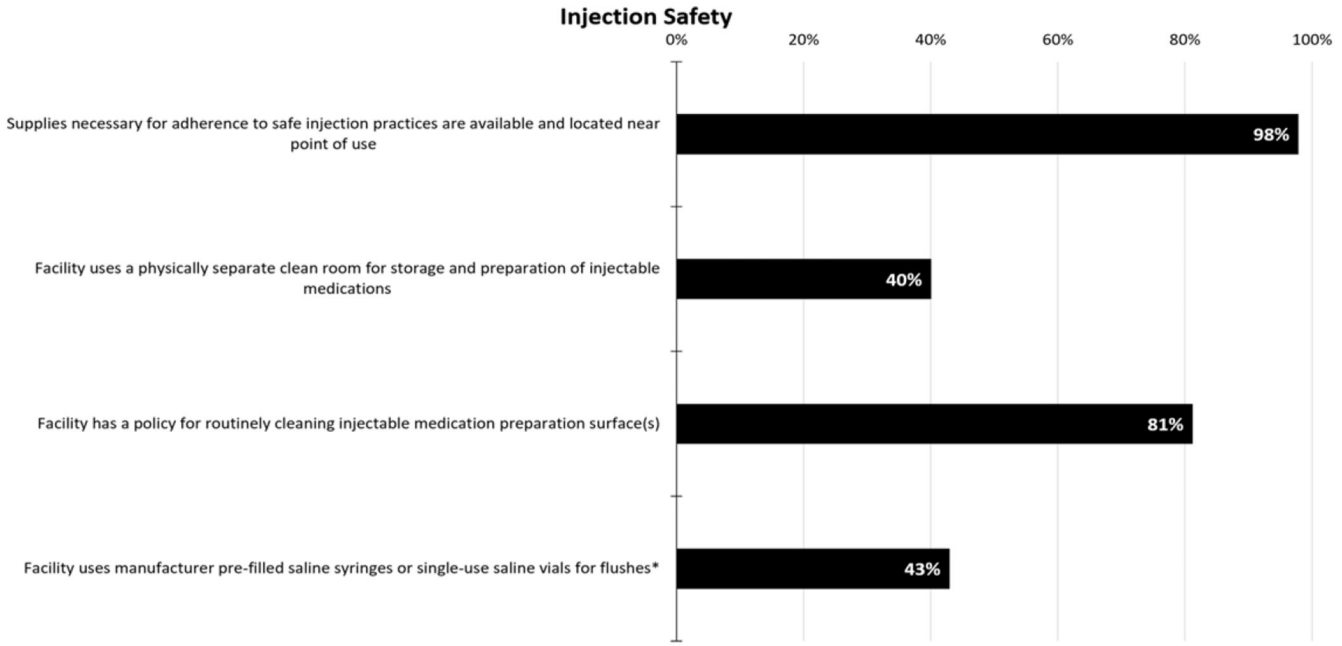

Figure 1.

Hemodialysis Facility Responses to Infection Control Assessment and Response (ICAR) Assessment Questions: Data from 800 visits, Division of Healthcare Quality Promotion, CDC – United States, 2015–2018. *Note*: CIC, Certification in Infection Control; HCP, healthcare personnel; BSI, bloodstream infection; NHSN, National Healthcare Safety Network; SIR, standardized infection ratio; MDRO, multidrug-resistant organism; PPE, personal protective equipment. *During the project, US federal regulations clarifying saline safe injection practices and recommendations for routine disinfection of the dialysis station were updated.

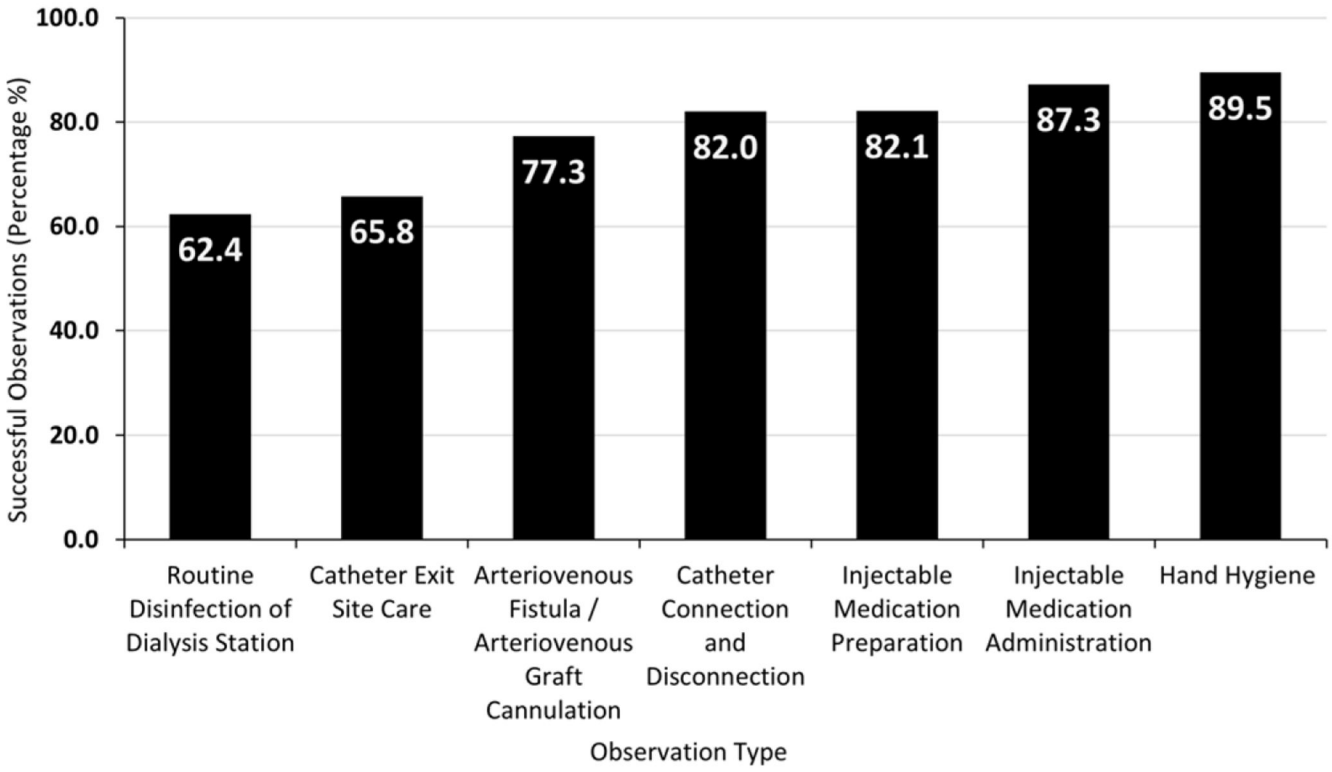

Figure 2.

Health Department Pooled Percent Adherence to Direct Observations of Hemodialysis Facility Infection Prevention Practices: Data from 764 visits, Division of Healthcare Quality Promotion, CDC – United States, 2015–2018 (N = 70,288). *Note*: Observation type numerators (# successful) and denominators (total # observed): Routine Disinfection of Dialysis Station = 4,487/7,195; Catheter Exit Site Care = 1,546/2,350; Arteriovenous Fistula/Arteriovenous Graft Cannulation = 5,168/6,688; Catheter Connection and Disconnection = 3,330/4,061; Injectable Medication Preparation = 3,122/3,802; Injectable Medication Administration = 3,098/3,550; Hand hygiene 38,169/42,642. Hand hygiene is an opportunity observation: Observation quantifies number of times staff performs hand hygiene (when indicated) versus total number of opportunities observed (when hand hygiene was warranted). All other observations were procedure observations where all steps must be completed for an observation to be successful.