



Systems Thinking and Leadership

How Nephrologists Can Transform Dialysis Safety to Prevent Infections

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Abstract

Infections are the second leading cause of death for patients with ESKD. Despite multiple efforts, nephrologists have been unable to prevent infections in dialysis facilities. The American Society of Nephrology and the Centers for Disease Control and Prevention have partnered to create Nephrologists Transforming Dialysis Safety to promote nephrologist leadership and engagement in efforts to “Target Zero” preventable dialysis infections. Because traditional approaches to infection control and prevention in dialysis facilities have had limited success, Nephrologists Transforming Dialysis Safety is reconceptualizing the problem in the context of the complexity of health care systems and organizational behavior. By identifying different parts of a problem and attempting to understand how these parts interact and produce a result, systems thinking has effectively tackled difficult problems in dynamic settings. The dialysis facility is composed of different physical and human elements that are interconnected and affect not only behavior but also, the existence of a culture of safety that promotes infection prevention. Because dialysis infections result from a complex system of interactions between caregivers, patients, dialysis organizations, and the environment, attempts to address infections by focusing on one element in isolation often fail. Creating a sense of urgency and commitment to eradicating dialysis infections requires leadership and motivational skills. These skills are not taught in the standard nephrology or medical director curriculum. Effective leadership by medical directors and engagement in infection prevention by nephrologists are required to create a culture of safety. It is imperative that nephrologists commit to leadership training and embrace their potential as change agents to prevent infections in dialysis facilities. This paper explores the systemic factors contributing to the ongoing dialysis infection crisis in the United States and the role of nephrologists in instilling a culture of safety in which infections can be anticipated and prevented.

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Introduction

Infections are the second leading cause of mortality in ESKD, resulting in 10% of deaths annually (1). Although many infections are preventable, nephrologists have been unable to solve this deadly and costly problem. In response, the Centers for Disease Control and Prevention (CDC) and the American Society of Nephrology (ASN) have created Nephrologists Transforming Dialysis Safety (NTDS), a landmark initiative to promote the nephrologist’s role in eradicating dialysis infections. This effort will challenge nephrologists as medical directors and attending physicians to “Target Zero Infections” and lead positive change. The work of NTDS is timely. Nephrology is being reshaped by larger transformative changes in health care, with a greater focus on value and increased provider accountability (2). Nephrologists need new knowledge and skills to navigate these changes and promote better patient outcomes (2–4).

The chief medical officers of major dialysis organizations in the United States have agreed on this need to address dialysis infections and patient safety (5,6). Hand hygiene highlights this issue. Year after year, improper hand hygiene is the most frequently cited safety violation in dialysis facilities, despite repeated

attempts at staff education (7). This persists, despite widespread awareness of the problem and the ready availability of CDC infection prevention tools and recommendations (8). The US Department of Health and Human Services includes dialysis facilities in its National Action Plan to eliminate health care–associated infections (9). Difficulty implementing these recommendations (Table 1) raises the broader question of why local actions aimed at preventing infections often fail (10). The answer likely stems from using solutions too simplistic for the multiple issues involved (10).

A nephrologist juggles inpatient consults, office hours, travel to and between dialysis facilities, and other administrative tasks—with little down time. Ownership of dialysis facilities has largely passed from nephrologists to large corporations, with most nephrologists operating independently of the dialysis facilities in which they practice. At the same time, nephrologist medical directors have been given more expansive duties and responsibilities under Medicare’s Conditions for Coverage. This larger scope of accountability was intended to empower nephrologists with official authority to make important decisions, improve quality, and ensure patient safety in their

Table 1. National dialysis infection prevention recommendations (information from refs. 8 and 9)

CDC 2016 Core Interventions for Bloodstream Infection Prevention	HHS 2013 5-yr National Metrics and Evaluation Targets
Decrease catheter prevalence Chlorhexidine for catheter site skin antisepsis Antimicrobial ointment at catheter site Catheter and vascular care access observations Staff education and competency Hand hygiene observations Surveillance and feedback using the NHSN Patient education and engagement	All bloodstream infections by access type Access-related bloodstream infections by type Seasonal influenza vaccine NHSN reporting Catheter use in patients on hemodialysis Screening for hepatitis C antibody Hepatitis B vaccine in patients on hemodialysis
CDC, Centers for Disease Control and Prevention; HHS, Department of Health and Human Services; NHSN, National Healthcare Safety Network.	

facilities. However, this power has been embraced with varying levels of enthusiasm, understanding, and effectiveness (2,3,11). Many leadership functions are unfamiliar to nephrologists with little formal training or experience managing people and organizations (4). This paper explores the systemic factors contributing to the ongoing dialysis infection crisis in the United States and the role of nephrologists in instilling a culture of safety, in which infections can be anticipated and prevented.

Systems Thinking and Learning Organizations in Targeting Zero Infections

Health care organizations often fail to learn from their mistakes and may lack effective solutions for complex problems, like infections (12). The Institute of Medicine (IOM) has proposed, iteratively, a comprehensive strategy to embrace continuous learning and improvement to help manage health care complexity (13). This mirrors the tenets of patient safety, with its emphasis on organizational learning (12–15). Harnessing human and organizational capabilities that improve the reliability and efficiency of care processes can help manage multidimensional problems, like dialysis infections (13). Inability to improve outcomes in chronic diseases with multiple contributing conditions, like ESKD, may result from not taking a holistic approach that accounts for the clinical, logistic, decision-making, and economic challenges involved (13). Failure to achieve patient safety and deliver high-reliability care is in the tendency of decision makers to simplify their view of the situation (16). Targeting dialysis infections thus requires nephrologists to adopt a broader, more comprehensive perspective and resist the temptation to simply the problem (16).

Systems thinking describes a diverse combination of theories and practices from the fields of economics, management, engineering, and psychology used to solve complicated problems (5–8). Dialysis facilities can be viewed as systems that show many interconnected and interdependent elements of a dynamic system (Table 2) (10). These elements possess complex linear and nonlinear relationships with variable cause and effect (10,16). Many facilities addressing infections make the mistakes of reducing their focus to a small subset of information available, simplifying cause and effect relationships, and limiting decisions to a few static options (5,16). This approach fails to consider systems interactions,

resulting in reliance on short-term technical solutions that fail and lead to unintended consequences (10,15).

Mapping actions and feedback loops into archetypes is a systems thinking technique that helps identify behavior contributing to a problem (14,15). Figure 1 portrays the archetype “shifting the burden,” which shows two routes to approaching a problem (15). There is a fundamental solution that addresses the underlying root causes, but it is frequently not appreciated. Instead, a symptomatic solution is usually chosen—the quickest, most apparent, or previously used method (15). This linear route is attractive, because it provides timely results and exists within the comfort zone of decision makers (15). However, because this misses the real underlying issue(s), the problem predictably reappears (15). Moreover, unintended consequences (shown by the negative sign) drain organizational focus and energy, preventing development of the fundamental solution (15).

Applying Systems Thinking to the Dialysis Facility

Figure 1 illustrates the archetype of a facility with a problem of poor adherence to the CDC guidelines for bloodstream infection prevention that is cited by a state surveyor. The fundamental solution is creating a more effective culture of safety to promote infection control. However, an immediate plan of correction is required. The symptomatic solution is to focus on staff retraining and disciplinary action, which satisfy the plan of correction and result in short-term improvements in compliance. However, the disciplinary actions by the state against the facility and the facility against employees have the unintended consequence of creating fear of punishment. This results in staff being afraid to report errors or policy breaches owing to fear of retribution. Furthermore, the initial success, reinforced under-reporting, leads to complacency and delays recognition of leadership and systems issues contributing to a poor safety culture. In this light, it is no surprise that dialysis infection control problems eventually resurface. Table 3 provides several examples of how systems thinking can be used to better solve infection control problems by identifying fundamental solutions.

Each dialysis facility is required by Conditions for Coverage to have a Quality Assessment and Performance Improvement (QAPI) program. QAPI is the ideal vehicle for application of systems thinking and robust data-driven methodology for identifying the root causes and specific interventions for infections (11,12). However, the QAPI process is not

Table 2. The dynamic systems elements in a dialysis facility and how they influence infections

Element	Problem	Context	Solution	Intended Consequence	Unintended Consequence	System Effect
Patient	Bloodstream infection	Limited understanding of infections	Antibiotics	Resolution of infection	<i>Clostridium difficile</i> , antibiotic resistance	Hospitalizations, mortality, costs
Dialysis technician	Multiple tasks, limited time	Rewards on the basis of efficiency	Shortcuts	Increased efficiency	Conscious deviation from policies	Patient harm policy resistance
Floor nurse	Multiple tasks, limited time	Litany of rules and regulations	Fix problems <i>via</i> punitive actions	Maintains compliance	Ineffective role model for technician	Less focus on patients and critical thinking
Nurse manager	Variable behavior of dialysis staff and nephrologists	Variable management skills	Create management action plans	Address compliance issues	Focuses on paperwork and not clinical care	Reduced visibility and ineffective nursing leadership
Nephrologist	Limited time for dialysis rounding	Competing priorities	Rely more on dialysis facility	Increased practice efficiency	Reduced accountability	Limited support of facility initiatives
Surgeons and interventionists	Limited number of provider options	High catheter prevalence	Outreach to operators	Reduce wait time for appointments	Patients assigned to newest partner	High number of access-related complications
Medical director	Variable engagement	Variable leadership skills	Relies on nurse manager to lead	Increased practice efficiency	Ineffective QAPI and team leadership	Poor safety culture in dialysis facility
Dialysis organization	Margin versus mission	Competition, economics, regulation	Vertical and horizontal integration	Increased market growth and profitability	Mistrust of corporate motives and priorities	Poor nephrologist engagement and collaboration
Government agency	Patient safety and reduction of harm	Suboptimal health outcomes and high costs	Expanding regulatory requirements	Improve health outcomes and lower spending	Short-term fixes arising from fear of punitive action	Regulation fatigue, lack of trust in agencies

QAPI, Quality Assessment and Performance Improvement.

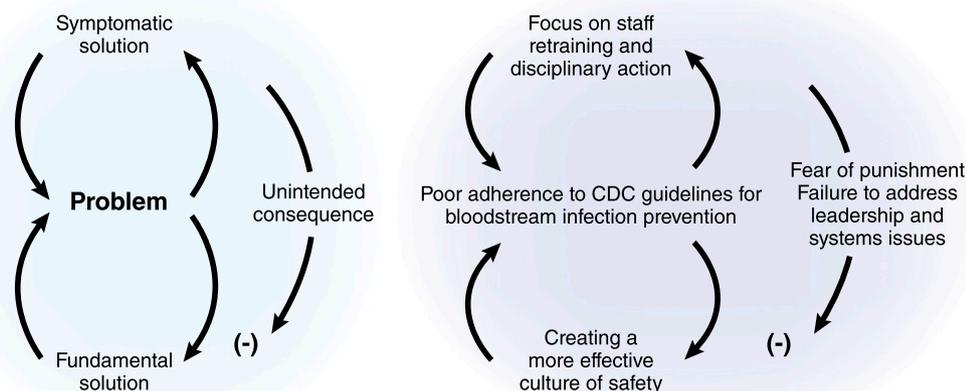


Figure 1. | Unintended consequences of short-term solutions to infection control problems: an example of the systems archetype shifting the burden. CDC, Centers for Disease Control and Prevention. Modified from ref. 15, with permission.

always intuitive, and many medical directors fail to appreciate or use this mechanism to its full potential (11). QAPI effectiveness can also be affected by (unwitting) attending nephrologist behaviors, such as refusing to follow protocols, not responding to facility or medical director inquiries, or conflicts with dialysis staff (17). Adopting systems thinking fits the QAPI process perfectly, and it would facilitate greater introspection and dialogue about the root causes of infections and encourage facility-wide cooperation. Better leadership and participation in QAPI and using systems thinking are tremendous improvement opportunities for medical directors and attending nephrologists alike.

Nephrologist Leadership Is a Requirement for Culture Change

However, use of effective process improvement, like QAPI, and creating supportive learning system competencies, including technology, are not enough (13,16). Ending preventable infections requires leadership's commitment to achieving zero patient harm and a fully functional culture of safety throughout the organization (13,16). Culture of safety is a critical factor in dialysis infections that is frequently acknowledged but less frequently realized (18). Culture describes the unspoken norms and rules that govern the behavior of a group of individuals (19). Groups facing common threats, like people in a dialysis facility, learn behaviors to help them survive. If these adaptations are successful, they are accepted tacitly and operate powerfully at the unconscious level (19). These adaptations help embody the culture of each dialysis facility and its degree of commitment to patient safety.

Dialysis infections often result from workarounds to infection control policies (7). Many of these shortcuts are intentional acts to improve performance rather than unintended errors (12,20). Complicated patients, highly technical processes, and short turnaround times create threats to work efficiency and stress in busy dialysis units. Management priorities and peer interactions may worsen this climate. A time-pressured caregiver consciously bypasses

dialysis infection control policies to “get the job done.” Seeing no immediate harm, he/she feels more comfortable repeating the shortcut. If the shortcut works well, other individuals see and adopt this behavior. A gradual shift of group norms called behavior migration occurs (12,20). Eventually, the workaround becomes imbedded in the culture of the dialysis facility, making change difficult.

The power of culture is apparent when infection control practices are challenged, which provokes resistance from dialysis staff, patients, and even the most experienced physicians. Questioning tacit cultural assumptions creates fears of loss of power, incompetence, punishment, or ostracism (19). This triggers defense mechanisms, resulting in hostility, denial, or blaming behaviors (19). Overcoming these emotions is the responsibility of leaders, who must communicate the urgency and need for change; then, they must obtain participation and remove barriers to effect long-lasting results (21). The medical director can have a powerful effect by setting the tone for infection prevention and showing the desired behavior and attitudes (19,21). By providing guidance and communicating a vision that eliminating preventable infections is both necessary and possible, the medical director can motivate and inspire others to follow. Eventually, reduction of anxiety occurs, and followers start to imbed the leader's beliefs as part of a new culture (19,21). Conversely, medical directors or other nephrologists can derail culture change if they are observed “not walking the talk” or give mixed messages to dialysis staff. Leadership and culture of an organization are interdependent. If either tolerates low expectations for patient safety, its members can and will make poor decisions (22).

The formula to promote a dialysis culture of safety relies, therefore, on two key factors. First, systems thinking—developing and adopting a broader, systematic approach to improving processes of care. Second, there must be visible and engaged leadership by the medical director who inspires a shared commitment to patient safety. Unfortunately, many nephrologists, including medical directors, do not view leadership as their responsibility (2–4,11,23). Although the nurse manager provides important situational

Table 3. Examples of using systems thinking to solve infection control problems

Problem	Linear Thinking	Linear Solution	Unintended Consequence	Systems Thinking	Fundamental Solution	System Effect
Dialysis staff members do not reliably follow policies	Staff are poorly trained and educated	Re-educate and retrain staff in infection policies	False security that problem is solved after remediation	Identify the work stressors causing workarounds	Correct workflow problems leading to shortcuts	Human factors designed work processes
High rate of bloodstream infections	The problem is related to high catheter use	Create vascular access nurse lead to increase AVFs	Failure to recognize other contributors	Perform a broad and thorough root cause analysis	Implement a comprehensive QAPI program	Longitudinal, holistic action and surveillance
Technician or nurse makes a major error	The employee is a “bad” worker and risk to patients	Discipline or terminate employee	Other staff are afraid to admit or report mistakes	Mistakes are an expected outcome of care	Foster psychologic safety for staff	Mutual trust facilitates earlier error detection
Employees are not accountable for actions	The facility needs to hire “better” people	Discipline or terminate employee	Skepticism and resentment lead to staff turnover	Accountability is a reflection of leadership	Management models consistent behaviors	Climate of shared responsibility for infections grows
Dialysis staff members resist attempts to change behavior	Staff are unwilling or unable to change behavior	Provide extrinsic rewards to promote changes	Reduced intrinsic motivation and “getting the why”	Challenging culture creates resistance	Use leadership to overcome staff anxiety and fears	Staff learn and adopt new beliefs as the new culture
Medical director is not an effective team leader	Medical director is unwilling or unable to do job	Nurse manager takes leadership role	Confusion about hierarchy of authority in unit	Mental models about authority affect behavior	Clarify designated and situational leadership roles	Leadership improves at all levels of facility
Lack of trust between doctors and management	The dialysis company only cares about profit	Doctor distances self from dialysis company agenda	Organizational initiatives fail to inspire doctors	A business model should reflect its strategic goals	Revise strategy and operational model	Organizational alignment fosters trust and goals
Reimbursement does not promote infection control	Link payments to performance to improve safety	Introduce quality measures tied to infection rates	Fear of financial penalties results in under-reporting	Facility culture will drive behavior around incentives	Change culture and incentives to promote safety	Reduces fear and encourages transparency

AVF, arteriovenous fistula; QAPI, Quality Assessment and Performance Improvement.

leadership, the medical director as designated leader of the dialysis facility must be the driving force to instill a culture of safety (13,21). By ensuring that the hierarchy of authority and responsibility is clear, the medical director creates synergy with the nurse manager's efforts to align attending nephrologists, dialysis staff, and patients to prevent infections.

The Importance of Strategic Leadership and Alignment

The majority of United States patients on dialysis are cared for in facilities owned by dialysis organizations that manage multiple facilities, often in many states—making oversight and communication between upper levels and front-line workers more difficult. Dialysis organizations have been charged with poor management, inadequate staffing, and prioritizing areas other than patient safety (24). However, the leadership of these organizations grasps and understands the importance of what is at stake with infection prevention (2,4,11). It is clearly to the advantage of dialysis organizations from a business sense to prevent infections to promote healthy patients who do not require hospitalization and live longer lives. These organizations have already spent considerable time and resources to detect and prevent infections. However, these efforts have not translated into sustained improvement at the operational level. Legislated infection control measures, like the National Healthcare Safety Network, have created controversy about facility under-reporting and data integrity, obfuscating discussion about the real goal of a large-scale, systematic, and process-driven infection control program in the United States to support local and regional efforts (25,26).

Leadership efforts to instill changes are often greeted with resistance, because individuals do not share the same mental models about the problem and how it affects them (27). Mental models are the ingrained assumptions, ideas, and beliefs that influence how individuals understand their

environment and behave—all elements of culture (27). A major source of dissonance encountered trying to change safety culture is misalignment of mental models, perspectives, priorities, and incentives throughout the macrosystem of United States dialysis care. Figure 2 illustrates a blueprint for aligning key levels of leadership that influence dialysis safety. With a systems thinking approach, the need for strategic alignment between senior leadership, middle managers, and front-line caregivers is apparent (13). Eliminating preventable infections will require senior leadership (the NTDS-ASN, dialysis organizations, and the CDC Making Dialysis Safer Coalition) to set the tone and aims at a strategic level (13). This will require medical directors and corporate middle managers at the organizational level to translate and execute this mission by enacting leadership and culture change (13). At the front-line level, the direct perspective of caregivers and patients will need to be understood, and appropriate interventions will need to be made *via* QAPI and human factors engineering to enable a safety culture.

An important lesson from the business sector is that attempts to implement major changes in strategy are often undermined by feedback loops in prevalent operational models that favor maintenance of the status quo (28). Figure 2 shows the interdependence of medical directors and those in the dialysis organization middle management who control operational aspects of care. Appreciation and modification of existing mental models are necessary to redesign business models to support desired changes (28). Indeed, the IOM stresses that, although systems-based learning is central to improving outcomes, the operational model is what makes this learning actionable in organizations by aligning goals, resources, and incentives (13). Although legislation and reimbursement ideally would support these changes, there remain considerable challenges to match policy decisions to a more individualized approach to quality in dialysis facilities (25). Systems thinking could

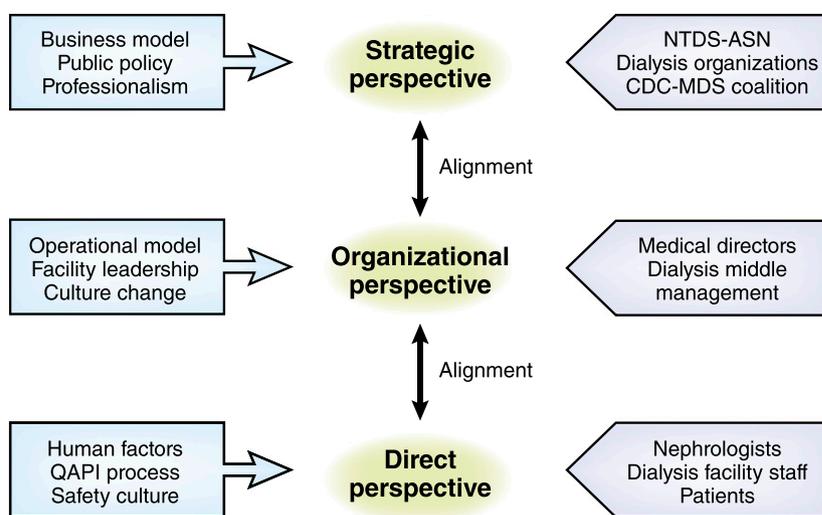


Figure 2. | A systems blueprint for transforming dialysis safety at key levels of leadership. CDC-MDS, Centers for Disease Control and Prevention Making Dialysis Safer Coalition; NTDS-ASN, Nephrologists Transforming Dialysis Safety-American Society of Nephrology; QAPI, Quality Assessment and Performance Improvement.

help enhance understanding between policymakers and the dialysis community about the intended and unintended effects of legislation (Table 3).

NTDS and the Future

Systems thinking also helps us appreciate why nephrologists may not have realized their potential for leading change in dialysis (2,4,11,13). Dialysis organizations often set policy from the top down, with the high purpose of providing safe and efficient care. An unintended consequence is that nephrologists feel disconnected from their role as leaders and decision makers in dialysis facilities. Medical directors and staff nephrologists may become complacent or disengaged as a result. Dialysis business practices may blur the line between nephrologist and customer, making it difficult to view dialysis organizations as colleagues. Although many stakeholders are involved in preventing dialysis infections, they cannot be expected to work on this issue effectively if nephrologists and dialysis organizations, the two constituents closest to the problem, are not fully engaged. The new approach will require nephrologists and dialysis organizations to re-examine their mental models and engage in open discussion about mutual goals, accountability, and steps needed to identify and address operational and leadership needs to advance patient safety and outcomes for the nearly 600,000 Americans on dialysis (29). NTDS is working with nephrologists and dialysis organizations to encourage this dialogue.

The mission to Target Zero Infections requires nephrologists to broaden their accountability and be effective leaders who help align interdependent health care systems (3,29,30). Some nephrologists may resist changes, because they lack training and experience in leadership (4). Others may have concern that there is inadequate time to devote to infection prevention. It is important to identify strategies to empower local physician leadership to accomplish these aims. The best and most insightful leader in a dialysis facility will not have a major effect in changing culture unless he/she can focus more on care processes in the dialysis facility. It will be important for medical directors to carefully consider their mental models of efficiency versus effectiveness. To improve patient safety, some time and assumed work efficiency must usually be sacrificed (12). However, a systems thinking view asserts that overall efficiency actually improves if time invested upstream with QAPI results in effective long-term preventative measures that avoid costly and harmful infections from occurring in the first place.

Although the challenge seems daunting, there are two important factors to consider. Nephrologists are naturally highly intrinsically motivated individuals already familiar with (physiologic) systems thinking. Systems learning and leadership training provided by NTDS is a readily available resource that can encourage application of nephrologists' inherent systems orientation to infections. Working with dialysis organizations, NTDS with other senior leadership can help identify the financial and operational barriers that demotivate nephrologists. Addressing these demotivators along with providing a clear mission, education, and support can be powerful means to harness the inherent willingness and volition of professionals, like nephrologists (31). Studies of extrinsic rewards versus intrinsic motivation

suggest that tangible rewards ultimately do not energize or sustain activities in the long term; rather, it is aspirational goals and learning—of which patient safety and leadership are of high order (12,31).

Patients on dialysis are often afraid of infections but receive little education about how infections occur and how they can be prevented. Patients, who spend many hours in the dialysis facility, are well positioned to observe and monitor how best practices to prevent infections are or are not being followed. Were patients trained to understand the importance of hand hygiene, surface cleanliness, access care, and catheter avoidance, they might better participate in infection control and feel empowered to speak up without fear of reprisal. Ultimately, we need to create the foundation for patient empowerment by asking nephrologists to lead culture change as medical directors, colleagues, teachers, and role models.

Infection prevention is a problem of dynamic complexity that will require systems thinking, culture change, and a commitment to learning by nephrologists to solve. Transforming dialysis safety must start with a vision and collective mindfulness that preventable dialysis infections cannot be tolerated. Nephrologists will need to partner with dialysis organizations in innovative and more effective ways. Nephrologists who commit to Targeting Zero Infections will find the skills and knowledge attained valuable to their careers as the demand for systems thinking in health care expands.

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