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Journal

Kidney360, 5(2)

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Publication Date

2024-02-01

DOI

10.34067/KID.0000000000000332

Peer reviewed

Special Article

Kidney360

Challenges in the Care of Patients with AKI Receiving Outpatient Dialysis: AKINow Recovery Workgroup Report

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Abstract

Background Up to one third of survivors of AKI that required dialysis (AKI-D) during hospitalization remain dialysis dependent at hospital discharge. Of these, 20%–60%, depending on the clinical setting, eventually recover enough kidney function to stop dialysis, and the remainder progress to ESKD.

Methods To describe the challenges facing those still receiving dialysis on discharge, the AKINow Committee conducted a group discussion comprising 59 participants, including physicians, advanced practitioners, nurses, pharmacists, and patients. The discussion was framed by a patient who described gaps in care delivery at different transition points and miscommunication between care team members and the patient.

Results Group discussions collected *patient perspectives* of (*1*) being often scared and uncertain about what is happening to and around them and (*2*) the importance of effective and timely communication, a comfortable physical setting, and attentive and caring health care providers for a quality health care experience. *Provider perspectives* included (*1*) the recognition of the lack of evidence-based practices and quality indicators, the significant variability in current care models, and the uncertain reimbursement incentives focused on kidney recovery and (*2*) the urgency to address communication barriers among hospital providers and outpatient facilities.

Conclusions The workgroup identified key areas for future research and policy change to (*1*) improve communication among hospital providers, dialysis units, and patients/care partners; (*2*) develop tools for risk classification, subphenotyping, and augmented clinical decision support; (*3*) improve education to providers, staff, and patients/care partners; (*4*) identify best practices to improve relevant outcomes; (*5*) validate quality indicators; and (*6*) assess the effect of social determinants of health on outcomes. We urge all stakeholders involved in the process of AKI-D care to align goals and work together to fill knowledge gaps and optimize the care to this highly vulnerable patient population.

KIDNEY360 5: 274–284, 2024. doi: https://doi.org/10.34067/KID.0000000000000332

Introduction

AKI is extremely common among hospitalized patients, particularly in the critically ill population.[1] AKI in patients admitted to intensive care units is associated with a high in-hospital mortality that is proportional to disease severity.[2] AKI survivors frequently do not recover to baseline levels of kidney function before discharge, and approximately 10%–30% will require outpatient dialysis treatments.[3] A proportion of patients with AKI requiring dialysis (AKI-D) will

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progress to kidney failure or ESKD requiring life-long maintenance dialysis or kidney transplantation. Patients with AKI face high risk for rehospitalization,[4] progression to kidney failure, and death, compared with those patients who did not develop AKI.[5] In addition, they face significant physical and mental challenges posed by their comorbid medical illnesses and prolonged critical illness.[3]

Patients with AKI-D face unique challenges in their health care delivery. Regardless of whether they are discharged to home or to intermediary health facilities, such as skilled nursing homes and rehabilitation facilities, hemodialysis treatments 2–4 times/wk can impede other medical needs, such as physician appointments and rehabilitation therapies.[6,7] Patients with AKI-D are treated at in-center hemodialysis facilities typically reserved for those with ESKD, but the needs of patients with AKI-D are distinct from those of patients with ESKD, and monitoring for kidney recovery is sometimes overlooked (Table 1).[8] Home dialysis therapies are currently not covered for patients with AKI-D. Information silos prevent sharing of critical medical information between hospitals and outpatient dialysis facilities, leading to significant challenges in care coordination among various health care providers. This fractured transition of care leads to patient dissatisfaction as reflected in a recent survey of AKI survivors in which 84% reported that AKI significantly affected their physical and mental health and approximately two thirds were concerned about the effect of their illness on their family.[9] Only about half of the respondents felt that the interdisciplinary communication among providers was good.

In 2019, the American Society of Nephrology (ASN) established a new taskforce titled AKINow, with a goal of promoting excellence in the prevention and treatment of AKI.[10] The AKINow Recovery workgroup is tasked with improving our understanding of the challenges faced by AKI survivors and bridging gaps in care after hospital discharge. To that effect, we conducted a group discussion addressing the challenges in the care of patients with AKI-D. This article summarizes key elements from the group discussion and provides insights into current evidence in the topic.

Methods

The discussion group had the following three core objectives: (*1*) to explore and understand gaps in care for AKI-D patients who survive an episode of AKI and are discharged with ongoing dialysis need, (*2*) to investigate opportunities to improve AKI-D recovery and transitions of care from hospitals to dialysis units, and (*3*) to guide the development of policies and best practice guidelines to advance the care of AKI-D survivors. Participants for the discussion group were recruited from a diverse group of AKI-D survivors and health care practitioners. Invited participants varied in their geographic distribution, years of practice experience, clinical discipline (primary care, nephrology, pharmacy, nursing), and practice setting (academic versus community, urban versus rural, and adult versus pediatric). The project was deemed not human subjects research by the Northwell Health Institutional Review Board (HSRD23-0073).

The participants were invited to a 3-hour virtual meeting and asked to complete a preparticipation questionnaire to summarize demographics and practice experience (for nonpatient participants). Fifty-nine individuals completed the preparticipation questionnaire, and 55 nonpatient participants were part of the discussion group on September 28, 2021, supported by nine ASN staff members (Figure 1). Proceedings included a patient testimonial, plenary sessions, facilitated subgroup discussions, and debriefing. The meeting was audio-recorded for future review. Eleven to twelve individuals were randomly assigned to each of five small subgroups and asked to discuss at least one core topic which included (*1*) optimum discharge planning of AKI-D survivors, (*2*) interventions that affect outpatient

Table 1. Comparison between clinical monitoring and targets in patients with ESKD and AKI-D receiving hemodialysis in outpatient dialysis units

Clinical Monitoring/Target	Patient with ESKD	Patient with AKI-D
General approach	Protocol oriented ESKD care	Individualized AKI-D care
Kidney function recovery	Not expected	Expected within approximately 3 mo
Monitoring for kidney recovery	Not required	Essential
• Urine output	• N/A	• Weekly
• Creatinine and urea clearance	• N/A	• Weekly
• Laboratory checks	• Monthly (maintenance)	• Weekly
Ultrafiltration per session	Infrequent adjustment	Frequent adjustment
	• Weekly or monthly	• Each session or weekly
	• Target "dry weight"	• Target "optimal weight"
Hemodialysis prescription	Infrequent adjustment	Frequent adjustment
	• Biweekly or monthly	• Each session or weekly
Mineral and bone disease	Standard goal-directed therapy	Individualized therapy
Anemia	Standard goal-directed therapy	Individualized therapy
BP	Standard guideline-based targets	Dynamic targets, permissive hypertension allowed
Vascular access	Avoid catheters, fistula first	Tunneled catheters
Key performance/quality indicators	Standardized	To be determined

N/A, nonapplicable.

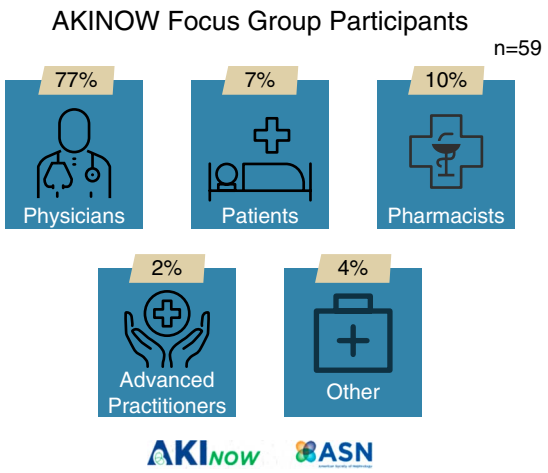

Figure 1. Infographic of AKI-D group discussion participants.

AKI-D care, (3) challenges and opportunities in the care of AKI-D survivors, (4) longitudinal and multidisciplinary care delivery strategies, and (5) collaborations between stakeholders to collectively improve AKI-D care. Each small subgroup discussion was coordinated by two facilitators from the AKINow Recovery Workgroup and one staff partner from the ASN responsible for note taking. Rather than attempting to achieve consensus, the objective of the small subgroup discussions was to capture the breadth and diversity of participant insights and recurrent themes. One facilitator from each small subgroup presented a brief summary of their discussion to all participants who were invited to offer additional insights to enrich the summary. AKINow Recovery workgroup members thereafter debriefed and summarized responses according to themes.

Results

Patient Perspective on AKI-D Care in the United States

The efforts of the ASN AKINow initiative are informed by the experiences of several AKI-D patients who received outpatient dialysis for AKI. An excerpt from a patient's (J. Willett) experience with AKI-D is shared below.

> "In August of 2020, I was hospitalized for coronavirus disease 2019 infection at a large medical center. I had complicated hospital course, and required the use of ventilator. I developed kidney injury and was started on dialysis. My wife was told that I only had 5% chance of survival. However, after 50 days in the intensive care unit I was discharged to a rehabilitation facility, where I stayed for 3 months. However, since my kidneys had not recovered function, I was scheduled for dialysis 3 times/wk at an outpatient dialysis facility."

> "The sudden and severe deterioration in my health was terrifying and prolonged hospitalization was extremely traumatic as I witnessed the deaths of two patients on the same floor as me. I remember the long dialysis sessions in the hospital—dialysis was not explained well to me at all and I had nothing to keep me occupied during treatments. After transitioning to outpatient dialysis unit, I experienced excellent care, and my nephrologist at the facility explained everything in detail to me... I cannot stress the critical impact that open and timely communication, a comfortable physical dialysis setting, and an attentive and caring staff can make for patient recovery. A positive experience is half the effort of getting well. I was relieved when my kidneys recovered sufficiently for me to stop dialysis."

Current Evidence Regarding Outpatient AKI-D Care

Among 55 nonpatient participants (see Figure 2 for clinical activities of participants) mostly practicing at academic centers, about one third were not aware that effective January 1, 2017 health care laws in the United States included a provision on coverage and payments for outpatient hemodialysis services for individuals with AKI-D.

The patient experience noted above served as an important catalyst to trigger discussions among the participants of the workgroup, as many were unaware of the struggles of AKI-D patients in the inpatient and outpatient settings. The patient experience demonstrates considerable challenges in care coordination as the patient was transferred between multiple medical facilities and then required outpatient dialysis at a freestanding dialysis unit while in a rehabilitation facility. The main goal of AKI-D outpatient care is to facilitate safe and rapid kidney recovery and dialysis liberation. However, if recovery is not attainable, the goal is to provide a tailored transition to chronic dialysis if in alignment with the patient's wishes. These goals are frequently hampered by clinical and policy-related challenges that stem from inadequate evidence to guide physicians and patients' decisions.

Recovery of kidney function resulting in independence from dialysis occurs variably in 20%–60% of AKI-D patients (see summary Table 2). Such wide variation in recovery rates likely reflects differences in underlying patient characteristics or differences in physician thresholds for dialysis initiation/discontinuation before hospital discharge, but modifiable factors, such as differences in kidney recovery monitoring strategies, may also be contributing. In addition, study populations are heterogeneous, including patients dialyzing in academic/hospital-based dialysis units, outpatient dialysis units, and rehabilitation facilities. Studies reporting on national datasets of patients with ESKD have also reported kidney recovery rates ranging from 20% to 40% when kidney failure was attributable to acute tubular necrosis or acute interstitial nephritis (Table 2). Most studies addressing the management of patients with AKI-D are observational, retrospective, single-center studies. Some studies have highlighted the association of fluid overload with lower likelihood for kidney recovery.[24,25] In addition, frequent episodes of hypotension during hemodialysis associate with nonrecovery of kidney function and cardiovascular outcomes in patients with AKI-D, but this observation has not been consistent across studies and is not necessarily causative in nature.[16,26]

Given the lack of high-quality evidence, pragmatic studies to identify modifiable risk factors, such as fluid overload and intradialytic hypotension and to classify

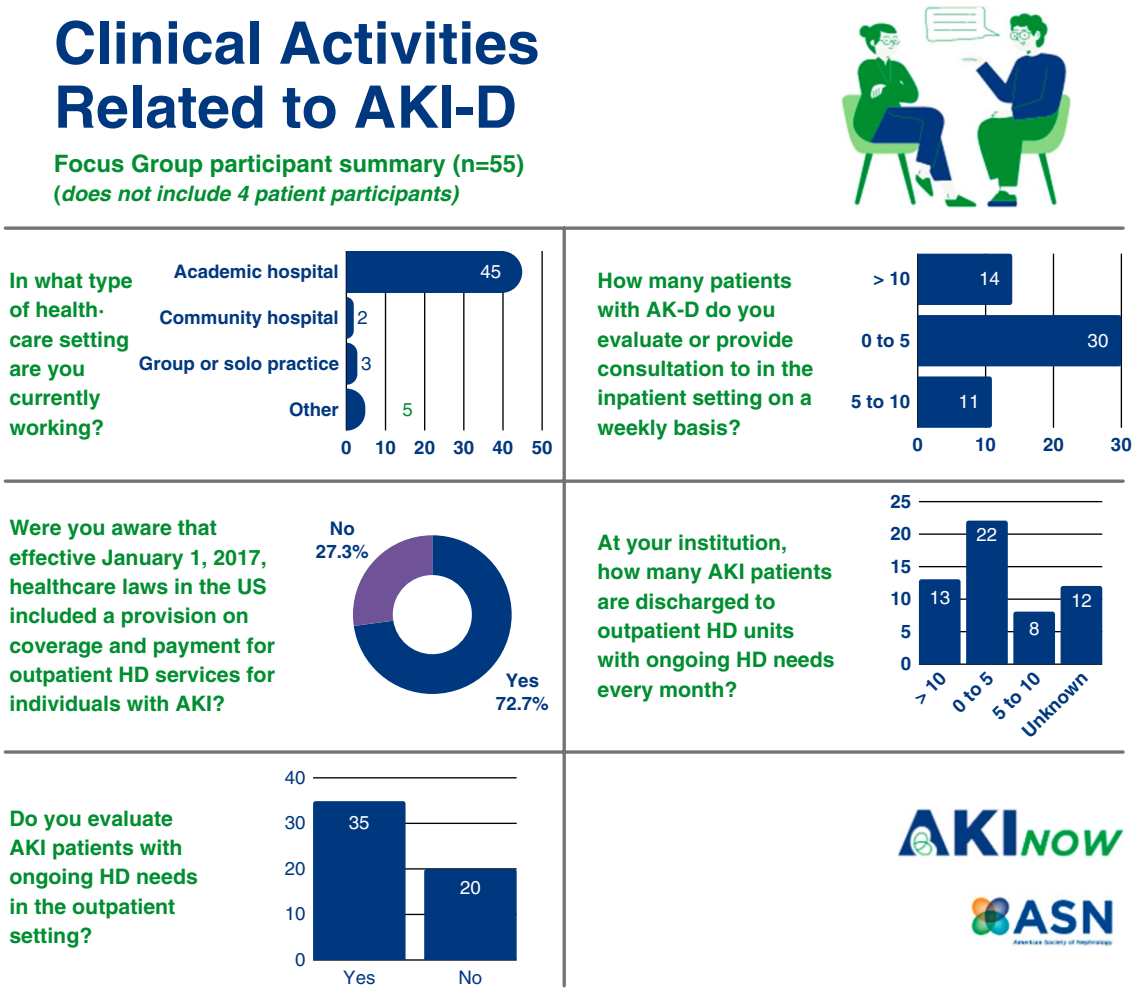

Figure 2. Infographic of clinical activities related to AKI-D among nonpatient group discussion participants.

high-risk AKI-D subpopulations are needed. To reach the ultimate goal of standardization, evidence-based protocols for better management of AKI-D patients, several clinical questions need to be addressed. The following points are not an exhaustive list but highlight important aspects of the care of the AKI-D patient: (*1*) prevention of hemodynamic instability during and after hemodialysis; (*2*) differences in anemia management between ESKD and AKI-D patients; (*3*) intensity of laboratory/urine output monitoring for assessing kidney recovery; (*4*) timing and selection of cardioreno protective medications, such as renin–angiotensin–aldosterone system inhibitors, sodium–glucose cotransporter-2 inhibitors, and diuretics; (*5*) communication and coordination of care among various subspecialists involved in the care of the patient; (*6*) determination of a transition point from potential for kidney recovery to irreversible kidney failure; and (*7*) inclusion of social determinants of health in patient education and care coordination.[27]

Equally important to ensure optimal delivery of care for patients with AKI-D is the need to re-evaluate current policies regarding payment for outpatient dialysis in the United States. Additional data are needed to guide which quality indicators should be selected specifically for the AKI-D population, as many ESKD quality indicators may not be relevant (Table 1). A strategy for the engagement of large dialysis organizations (LDOs) as key stakeholders and promoters of kidney recovery is important, as is the development of an AKI-D living registry to follow this understudied population.[7,28]

Current Challenges in Outpatient AKI-D Care

The lack of evidence described above has resulted in variability in clinical practice. The discussion group identified several key challenges and unanswered questions in the delivery of care for patients with AKI-D in the outpatient setting. See Supplemental Material for link to the discussion recording and slide deck on the ASN Excellence in Patient Care Website. The initial obstacle begins at hospital discharge when patients are transferred to outpatient dialysis facilities. Electronic health record (EHR) silos prevent appropriate communication among hospitals, subacute care facilities, and dialysis centers and can potentially result in medication errors and missed appointments. During this transition period, communication on discharge summaries is often incomplete,[29,30] lacks relevant kidney-related information, and is often not transmitted to the nephrologists or dialysis facilities in a

Table 2. Summary of selected studies reporting on kidney recovery outcomes of patients with either ESKD or AKI-D

Year	Sample	Data Source	AKI-D Recovery Definition	Proportion of Kidney Recovery	Factors Associated with Kidney Recovery in AKI-D
2021[a,11]	*N*=1,953,881 incident hemodialysis patients[b] ATN: *N*=14,380 AIN: *N*=1381 All included patients had ESKD diagnosis	USRDS 1996–2015 The data in this study included both adults and children. In this table, we report only the results from the adult population[b]	(*1*) Independence of dialysis and did not have an episode of restarting dialysis within 90 d of the date of recovery (*2*) The patient did not die within 90 d of stopping dialysis treatment (and potentially withdraw from dialysis therapy) (*3*) The patient did not receive a kidney transplant within 90 d of stopping dialysis	4.3% of adults with incident dialysis recovered within 1 yr If broken down by primary cause of kidney disease ATN: 29.3% recovered AIN: 32.8% recovered	N/A
2021[6]	*N*=111 AKI-D patients discharged from the hospital with continued hemodialysis need	University of Kentucky 2017–2019	Alive with independence from dialysis at 90 d after discharge	40.5%	Younger age group Fewer comorbid conditions Higher baseline eGFR
2021[12]	*N*=10,821 Medicare patients dialyzed outpatient for AKI-D	Medicare claims 2017	Absence of submission of CMS form 2728 indicating need for maintenance dialysis but appearing in the enrollment database, discontinuation of dialysis as evidenced by no further dialysis claims submission, no evidence of death, and no evidence of receipt of a kidney transplant	18.6%	N/A
2020[a,13]	*N*=32,598 incident dialysis patients with ATN as the cause of ESKD	USRDS 2005–2014	Independence of dialysis within 12 mo post-ESKD	33.5%	Male sex White race Younger age Lack of comorbid conditions Predialysis nephrology care
2019[b,14]	*N*=2214 AKI-D patients with predicted inpatient mortality of <20%	Kaiser Permanente Northern California 2009–2015	Independent of dialysis within 90 d after dialysis initiation and survival for ≥4 wk after discontinuation	40.9%[b]	Younger age Higher baseline eGFR Higher preadmission hemoglobin Absence of heart failure and chronic liver disease
2019[15]	*N*=41 AKI-D patients discharged to LTACH	University of Kentucky 2015–2018	Independence of dialysis at LTACH discharge	65.8%	Fewer episodes of intradialytic hypotension Absence of anemia Fewer dialysis sessions

Table 2. (Continued)

Year	Sample	Data Source	AKI-D Recovery Definition	Proportion of Kidney Recovery	Factors Associated with Kidney Recovery in AKI-D
2018[16]	*N*=100 AKI-D patients who survived hospital discharged and required outpatient dialysis	University of Michigan 2013–2015	Independence of dialysis at 90 d after hospital discharge	43.0%	White race Higher baseline kidney function The use of CRRT versus IHD Higher urine output at discharge
2017[17]	*N*=91 AKI-D patients treated in outpatient affiliated unit	University of Virginia 2012–2013	Independence of dialysis beyond 90 d after hospital discharge	35.2%	Higher baseline kidney function Absence of prior AKI
2015[18]	*N*=281 AKI-D patients treated in outpatient affiliated unit	Mayo Clinic Health System 2006–2009	Independence of dialysis	19.0%	ATN as the cause of AKI Absence of heart failure Higher baseline eGFR
2015[19]	*N*=119 AKI-D patients treated in outpatient affiliated unit	University of Virginia 2012–2013	Independence of dialysis	42.0%	Absence of heart failure Higher baseline eGFR Absence of prior episode of AKI within the preceding 6 mo
2013[a,20]	*N*=194,007 incident hemodialysis patients All included patients had ESKD diagnosis	Medicare CMS data 2008–2009	Independence of dialysis without recurrence up to 3 yr after initiation	5.7% had sustained kidney recovery The primary cause of ESKD among those who recovered: AIN (42.7%) ATN (37.0%)	N/A
2009[b,21]	*N*=703 AKI-D patients	Kaiser Permanente, California 1996–2003	Independence of dialysis at 30 d after discharge	48.8%[b]	N/A
2009[b,22]	*N*=1061 AKI-D patients with baseline CKD (eGFR <45 and ≥15)	Kaiser Permanente, California 1996–2003	Independence of dialysis at 30 d after discharge	20.1%[b]	N/A
2006[b,23]	*N*=425 critically ill patients with AKI-D due to ATN	University of Munich 1990–2001	Complete recovery: Independence of dialysis and SCr back to baseline at discharge Partial recovery: Independence of dialysis but SCr not back to baseline at discharge	Complete recovery: 29.1%[b] Partial recovery: 23.1%[b]	Patient characteristics, severity of illness, dialysis modality were not associated with kidney recovery

AKI-D, AKI requiring dialysis; AIN, acute interstitial nephritis; ATN, acute tubular necrosis; CMS, Centers for Medicare & Medicaid Services; CRRT, continuous RRT; IHD, intermittent hemodialysis; LTACH, long-term acute care hospital; N/A, nonapplicable; USRDS, United States Renal Data System; SCr, serum creatinine.
[a]The selected studies included patients discharged before January 1, 2017, and therefore, all were discharged with ESKD status, which was attributable to AKI, but not AKI-D status.
[b]The selected studies included outcome measures of kidney recovery that did not differentiate between inpatient and outpatient recovery.

Table 3. Summary of workgroup recommendations to improve AKI-D care in outpatient settings

Actionable Item	Current Status	Recommendations
1. Effective communication among providers in hospitals, dialysis units, and with patients/care partners	Lack of standardization with inaccurate documentation and erratic/interrupted communication among providers Patients most of the time are not aware of their AKI diagnosis, their recovery prognosis, and how to monitor their kidney recovery	Standardize documentation of AKI-D care when transitioning from inpatient to outpatient settings, making the patient a key stakeholder in the communication process
2. Development and validation of useful tools for risk classification, subphenotyping, and augmented clinical decision support	Most data-driven tools are based on retrospective data without adequate external and prospective validation. The potential utility of these tools in the care of AKI-D patients is currently unknown	Establish core clinical and patient-centered outcomes and outcome measures tailored to AKI-D patients Create informatics resources for collection and harmonization of real-time multimodal data suitable for federated learning approaches that can assist with artificial intelligence-based tool development, validation, and implementation
3. Effective education to providers, staff, patients, and care partners	Absence of validated tools for AKI education to patients/care partners Heterogeneous practice patterns among providers in part due to lack of evidence	Validate and implement AKI educational tools on the basis of patient and provider feedback Generate awareness about gaps in AKI-D care to engage bedside providers into adherence to best practices as these evolve
4. Identification of best practices and testable interventions to improve clinical and patient-centered outcomes	Absence of large and accessible AKI-D databanks to explore current practices and identify modifiable risk factors of kidney recovery beyond USRDS and CMS public data, which lack granularity and are not linked to index hospitalization with the inciting AKI-D event	Develop longitudinal observational data throughout the AKI-D continuum and consensual best practices guided and updated according to evolving evidence Engagement of LDOs to provide outpatient dialysis unit data that could be linked to EHR data from the corresponding AKI-D hospitalization Design and conduct clinical trials testing innovative interventions in AKI-D patients
5. Identification and validation of quality indicators to promote best practices	No quality indicators for AKI-D care	Use Delphi methodology for multifocal expert consensus of potential AKI-D quality indicators that can be subsequently validated in prospective studies
6. Assessment of SODH in AKI-D care	Paucity of data about the effect of SODH in AKI-D care	Incorporate SODH into AKI-D datasets and incentivize investigations assessing their effect in patient care

EHR, electronic health record; LDO, large dialysis organization; SODH, social determinants of health; USRDS, United States Renal Data System.

timely manner.[31] Furthermore, patients may be unaware of their AKI diagnosis and its implications.[32,33] Even when patients were aware of their AKI status, they had inadequate knowledge about AKI and prioritized conditions other than AKI. In addition, many outpatient dialysis facilities are unfamiliar with how AKI-D care differs from ESKD care. For example, a survey study of 104 nephrology providers found that only 35% have different protocols for patients with AKI-D in outpatient units.[8]

Even when patients with AKI-D are identified, it is unclear who is most likely to recover kidney function and how to monitor for recovery. Some predictors of recovery include baseline eGFR and proteinuria,[18,34] but there have been few studies on how different clinical subphenotypes and biological endo-phenotypes of AKI affect recovery. Common markers of recovery include increasing urine output, decreased interdialytic weight gain, and down trending predialysis serum creatinine. Detecting these signs depends on patient reporting and/or health care provider awareness and may be obscured by traditional thrice-weekly hemodialysis and lack of validated benchmarks of recovery. For example, a meta-analysis of 23 studies could not determine an optimal threshold for urine output due to study heterogeneity.[35] Some groups have recommended timed urine collections,[36] but these can be logistically cumbersome to collect. Moreover, an average

of measured urea and creatinine clearance may be needed as creatinine may overestimate GFR and urea underestimate GFR for patients on dialysis.[37] Similarly, the value of biomarkers of kidney injury/dysfunction/recovery in the assessment of AKI-D recovery requires investigation. Challenges in recognizing who is likely to recover in a timely fashion impede research into practices that promote recovery.

Future research is sorely needed to guide the clinical treatment of AKI-D patients. The feasibility of implementing personalized hemodialysis prescriptions for AKI-D patients in outpatient dialysis units was recently highlighted in a pilot study.[38] Furthermore, the challenges of preclinical AKI models, beyond the scope of this manuscript but discussed elsewhere,[39] have stymied the translation of promising inventions into successful clinical trials. Data supporting the clinical management of AKI-D to promote kidney recovery are also lacking. Optimal strategies to minimize intradialytic hypotension and preserve kidney perfusion need further delineation. In the recent Standard versus Accelerated Initiation of Renal Replacement Therapy in AKI trial of accelerated versus standard dialysis for critically ill patients with AKI, patients randomized to the accelerated arm received more dialysis, experienced more intradialytic hypotension, and had higher rates of dialysis dependence at 90 days.[40] These data suggest that strategies to minimize unnecessary dialysis warrant study in the AKI-D population. Other examples include different dialysate prescriptions (*e.g.*, low temperature or varying sodium concentrations), conservative and/or personalized ultrafiltration rates, and changes to the frequency or duration of hemodialysis to minimize hemodynamic alterations. The role of furosemide to increase urine output is unclear, as are BP targets and adjuvant treatment regimens. The management of anemia and phosphate for patients with AKI-D often mirrors that of patients with ESKD, but the implications of such approaches on kidney recovery are unknown. Patients with AKI-D also have several functional and emotional limitations with some reporting a quality of life equivalent to death.[41] Impairments in return to work, engagement with hobbies, and driving are often described in survivors of AKI, which are more pronounced in those with AKI-D.[42] Therefore, how diet, physical therapy, and mental/emotional treatment contribute to recovery warrants further attention.

Variability in current practices for AKI-D provides the opportunity to compare different strategies to identify best practices. Unfortunately, lack of standardization in AKI-D also affects data capture and infrastructure. Only recently, patients with AKI-D have been easily identifiable in the Centers for Medicare & Medicaid Services databases,[7] but granular details on kidney function, AKI subphenotypes, monitoring strategies, and hemodialysis practices are often missing.[13] Some of this information may be available at the level of LDOs and individual dialysis facilities, but an integrated strategy to the collection, measurement, and availability of data on patients with AKI-D is needed to overcome the aforementioned challenges and improve delivery of precision medicine for this vulnerable population.

Ethical Considerations of AKI-D Care

There are ethical considerations that affect AKI-D care, including the context for initiation, the funding model,[43] and social determinants of health.[44,45] The context of AKI-D is distinct from ESKD in that the choice to offer or receive dialysis hinges on an uncertain likelihood of recovery. Individuals with critical illness, poor health literacy, socioeconomically marginalized backgrounds, language barriers, or cognitive impairment may not fully understand the implications of dialysis initiation.[45] The coronavirus disease 2019 pandemic further exacerbated challenges in AKI-D care by introducing resource scarcity and a clear need to establish transparent policies for equitable care.[46] Importantly, another aspect to recognize is that current financial models do not incentivize kidney recovery but the provision of dialysis to AKI-D patients, which could be seen as a competing risk.

The funding model for AKI-D care in the United States is another factor that affects dialysis access and availability.[43] The total market value for dialysis in the United States was estimated at $75 billion in 2011,[45] of which only a fraction is attributed to AKI-D care. In 2017, policy change in the United States allowed reimbursement for the provision of hemodialysis to ambulatory patients with AKI-D in outpatient dialysis facilities. Before this change, patients continued dialysis while hospitalized or received dialysis in rehabilitation facilities or hospital-based dialysis units until kidney recovery or declaration of ESKD.[7] In addition, geographically dispersed and underserved populations may be disproportionately affected by transportation challenges, additional costs, and an inability to get time off work to reach dialysis facilities.[43]

Important factors associated with outcomes in dialysis populations including the racial composition of the patient population in the facility or neighborhood remain largely unaddressed.[44] Undocumented immigrants also require further consideration. In ESKD care, emergency-only hemodialysis has been the historical standard for undocumented immigrants. However, it has been demonstrated that this practice of waiting until the patient experiences a critical condition requiring acute dialysis contributed to a higher risk of death,[47] substantially worse quality of life, and fear and distrust of the health care system by patients.[48] For this reason, several states have independently pursued legislation to increase access to routine dialysis care for undocumented immigrants with ESKD. To our knowledge, specific data pertaining to undocumented patients with AKI-D are not available.[49]

Summary and Recommendations

Achieving optimal transition-of-care for patients with AKI-D should be a research and policy priority. The electronic discharge summary is currently the main tool to communicate a patient's discharge diagnoses and care plan, but it is clearly insufficient to carry valuable information to out-of-network facilities, such as the LDOs.[50] To improve discharge communications, health systems need to leverage EHR to automate the inclusion of accurate and relevant AKI-related information into the discharge documents[51] and send the documents to the outpatient

providers/dialysis units in a timely manner.[52] Ideally, there should be bidirectional communication between the inpatient and outpatient nephrology teams either *via* electronic platforms or phone calls. Furthermore, artificial intelligence/machine learning could enhance these communications with embedded validated risk prediction models and clinical decision support tools that can augment clinicians' decisions at the bedside and provide patients with more accurate prognoses.[53] A summary of recommendations from the AKINow Recovery workgroup is presented in Table 3.

In parallel to improving communication between health care providers at different facilities and with patients and care partners, there is a need to enhance and validate educational tools for patients/care partners and health care providers about AKI. In addition to general education about dialysis, medications, and kidney-specific diet,[54] the AKI-D population needs tailored information related to their kidney recovery prognosis. In particular, AKI-D patients need to learn about their chances of kidney recovery, how they can actively monitor their recovery (*i.e.*, increments in urine output), and steps to protect their kidneys by avoiding nephrotoxins and controlling their comorbidities.[55] Ideally, dialysis units should have a specific AKI-D protocol that delivers effective AKI education, dynamically monitors kidney recovery, and ensures that patients will continue to receive nephrology care outside of the dialysis unit when they discontinue dialysis.[8]

Finally, to improve and deliver quality AKI-D care, our community of multiple stakeholders should collectively develop prospective AKI-D registries and establish networks for collaborative interventional studies to gather clinical and process evidence to improve the quality of care and relevant outcomes. Registry-based longitudinal data including EHR and dialysis unit data could help identify modifiable risk factors and AKI-D subphenotypes that can be validated in prospective studies and move our field toward quality and personalized AKI-D care. There is a large unmet need for prospective studies to test potential therapies and define biomarkers that can predict recovery versus permanent loss of kidney function. The experiences of patients with AKI-D are sobering and should motivate all of us to think and work outside the figurative box (the dialysis unit) and improve their care.

Disclosures

E.M. Abdel-Rahman reports the following: Research Funding: Covance and NIH PCORI Study; and Advisory or Leadership Role: Member AKINow recovery group. E.F. Barreto reports the following: Consultancy: Wolters-Kluwer; Research Funding: AHRQ and NIAID; and Honoraria: Vifor Pharma. J. Cerda reports the following: Ownership Interest: New York Nephrology—Shareholder; Advisory or Leadership Role: American Society of Nephrology: Chair, AKI!Now Initiative; International Society Nephrology AKI Committee and CoChair, 0by25 Initiative; and International Society of Nephrology Chair, Advocacy Working Group; and Other Interests or Relationships: ASN AKI!Now Initiative; Associate Director, 0 by 25 Initiative, International Society of Nephrology; and Member of the ASN Online AKI Community. B. Freshly reports the following: Employer: American Society of Nephrology (contractor). L. Gewin reports the following: Consultancy: Morphic and Surrozen; Research Funding: NIH and VA; Honoraria: Daiichi Sankyo; Advisory or Leadership Role: Editorial boards for *American Journal of Physiology Renal Physiology*, *Frontiers in Nephrology*, *JASN*, *Kidney360*; Executive Council for Women in Nephrology and Council member for Southern Society of CLinical Investigation; and External Scientific Advisor, Kidney Institute of New Mexico; and Other Interests or Relationships: member of American Heart Association, American Physiological Society, American Society of Nephrology, and Southern Society for Clinical Investigation. I. McCoy reports the following: Other Interests or Relationships: Research funding from Satellite Healthcare Inc. (nonprofit). J.A. Neyra reports the following: Employer: University of Alabama at Birmingham; Consultancy: AcelRx, Baxter, Leadiant Biosciences, Outset Medical, and Vifor Pharma; and Advisory or Leadership Role: Guest Editor, *Critical Care Nephrology in Advances in Chronic Kidney Disease*; Editorial Board, *Advances in Chronic Kidney Disease*, *American Journal of Kidney Diseases*, and *Kidney360*; and Section Editor, *Clinical Nephrology*. J.H. Ng reports the following: Consultancy: Vifor Pharmaceuticals; Ownership Interest: PublishedMD Consulting LLC; Research Funding: NIH/NIDDK. Award number: 1K23DK132459-01; Honoraria: Advocate Christ Medical Center; Advisory or Leadership Role: Editorial Board Member of ASN Kidney News (unpaid); Editorial Board Member of *Advances in Chronic Kidney Disease* (unpaid); and Other Interests or Relationships: Founder of PublishedMD Consulting LLC. S.A. Silver reports the following: Consultancy: AstraZeneca; Honoraria: Baxter, Novo Nordisk, and Otsuka; and Advisory or Leadership Role: Canadian Society of Nephrology Board Member. A. Vijayan reports the following: Consultancy: Astute and NxStage; Research Funding: Spectral; Honoraria: Baxter, Medscape, and NxStage; and Other Interests or Relationships: Member, National Kidney Foundation. J. Willett reports the following: Employer: Patient Advocate. All remaining authors have nothing to disclose.

Funding

J.A. Neyra: NIDDK (R01DK128208, R01DK133539, U01DK12998, P30 DK079337).

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Data Sharing Statement

All data is included in the manuscript and/or supporting information. Original data created for the study are or will be available in a persistent repository upon publication.

Supplemental Material

This article contains the following supplemental material online at https://epc.asn-online.org/projects/akinow/akinow-recovery-post-aki-workgroup/.

Link to the discussion recoding and slide deck on the ASN Excellence in Patient Care (EPC) Website: https://epc.asn-online.org/projects/akinow/akinow-recovery-post-aki-workgroup/

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Published Online Ahead of Print: December 6, 2023

J.A.N. and L.G. are co-first authors.