NARRATIVE REVIEW

CKD as an Underrecognized Threat to Patient Safety

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Chronic kidney disease (CKD) is common, but underrecognized, in patients in the health care system, where improving patient safety is a high priority. Poor disease recognition and several other features of CKD make it a high-risk condition for adverse safety events. In this review, we discuss the unique attributes of CKD that make it a high-risk condition for patient safety mishaps. We point out that adverse safety events in this disease have the potential to contribute to disease progression; namely, accelerated loss of kidney function and increased incidence of end-stage renal disease. We also propose a framework in which to consider patient safety in CKD, highlighting the need for disease-specific safety indicators that reflect unsafe practices in the treatment of this disease. Finally, we discuss the hypothesis that increased recognition of CKD will reduce disease-specific safety events and in this way decrease the likelihood of adverse outcomes, including an accelerated rate of kidney function loss and increased incidence of end-stage renal disease.

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Patient safety has been identified as a high-priority area for improvement in health care. In 1999, the Institute of Medicine issued a report entitled "To Err Is Human: Building a Safer Health System" that included the widely cited statistic that 44,000 to 98,000 in-hospital deaths occurring each year were caused by medical errors.[1] The Agency for Healthcare Research and Quality (AHRQ) has taken the lead in guiding efforts in improvement of patient safety and reducing medical errors.[2-5] However, despite their efforts, these improvements have been slow in coming across the health system.[6] Definitions of safety incidents vary, and in an effort to apply standards in measurement of patient safety across hospitals and health systems, the AHRQ established a set of patient safety indicators (PSIs).[2] Using these PSIs, several investigators have identified variations in patient safety events across hospitals,[7,8] by payer status,[9] and with varying demographic factors, including race and ethnicity.[10]

Despite the acceptance of the AHRQ PSIs as a set of tools to evaluate patient safety, these measures have many shortcomings.[11] First, the AHRQ PSIs capture only a portion of the type of events that might be included in the domain of patient safety. Others use alternative definitions of patient safety and place a greater emphasis on medication errors,[12] which are absent from the AHRQ PSIs. Moreover, the AHRQ PSIs optimally are used to evaluate in-hospital incidents, which are only a subset of all patient safety events. Also, the AHRQ PSIs generally have low incidence rates in the hospital population and often require large sample surveys to assess trends and test hypotheses. This could occur partly because the AHRQ PSIs are heavily weighted to surgical and obstetric misadventures. However, it is plausible and likely that the majority of patient safety problems are in the growing population of Americans who have chronic medical ailments, including chronic kidney disease (CKD).

In this review, we discuss the various aspects of CKD that make it a uniquely high-risk condition for both general and disease-specific adverse safety events. We assert that new efforts are needed to formally define PSIs that are specific to CKD and derived from the unique disease attributes described. We propose the use of the

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Donabedian structure-process-outcome paradigm as a foundation for the consideration of disease-specific patient safety in CKD.[11,13] We also discuss the potential role of increased disease recognition as a key structural intervention necessary to reduce the incidence of CKD-specific safety events and in turn reduce the incidence of adverse disease outcomes, including hastened kidney function loss and incidence of end-stage renal disease (ESRD).

CKD IS A HIGH-RISK CONDITION FOR ADVERSE SAFETY EVENTS

CKD is becoming increasingly prevalent in the United States,[14,15] and with its complexity and preponderance of comorbidities, this disease often requires frequent hospitalizations and prolonged length of hospital stay and has an increased cost of care.[16-18] The diagnosis of CKD frequently is underrecognized,[19-21] and the failure to recognize CKD in patients who are frequent users of the health system is a lost opportunity to initiate recommended treatments for the disease and minimize threats to patient safety.

In a national cohort of veterans receiving care at the Veterans' Health Administration with at least 1 hospitalization during fiscal year 2004 to 2005 and an outpatient creatinine level for determination of estimated glomerular filtration rate, we examined whether CKD was a risk factor for the incidence of AHRQ-established PSIs. We showed that CKD was a significant risk factor for several AHRQ PSIs and showed a stepwise increase in risk of a composite of all PSIs with decreasing kidney function. We concluded that CKD was a risk factor for the general AHRQ-derived PSIs, but noted that these indicators tended to be uncommon in a general population and did not have a high degree of relevance in patients with a chronic medical condition, such as CKD. It was clear from the study that a set of disease-specific safety indicators were needed for CKD.[22]

Manifestations of CKD that relate to patient safety can range from sequelae of the disease that are improperly managed to consequences of misguided therapeutic interventions used in this highly comorbid disease population and are listed in Box 1. Many of these are not mutually exclusive and have the potential to relate to others on the list. These clinical events are not included in the AHRQ-derived set of PSIs, but comprise the basis for a disease-specific set of safety events in patients with CKD. Although there is a substantial body of literature describing these events, there has been minimal consideration of them within the context of patient safety or the extent to which they fit on the spectrum, ranging from inadequately managed disease sequelae to unanticipated iatrogenic complications of a treatment or intervention.

Box 1. Features of Chronic Kidney Disease and Its Management That Relate to Patient Safety

1. Medication errors[23-26]
   a. Improper dosing
   b. Inappropriate prescription
   c. Inadequate monitoring
2. Hyperkalemia[27,28]
3. Hypoglycemia[29,30]
4. Other electrolyte intoxication
   a. Hypermagnesemia[31,32]
   b. Hyperphosphatemia[33]
5. Diagnostic testing
   a. Iodinated contrast[34,35]
   b. Gadolinium[36]
6. Cardiovascular disease
   a. Missed diagnoses[37]
   b. Improper management (hemorrhage, restenosis)[38,39]
7. Fluid, RAAS blocker, diuretic mismanagement[40-42]
   a. Hypotension
   b. Azotemia
   c. CHF exacerbation
8. Acute kidney injury[43-45]
9. Miscellaneous
   a. Hip fracture[46]
   b. Deep vein thrombosis[47]
   c. Multiresistant bacterial infection[48]

Abbreviations: CHF, congestive heart failure; RAAS, renin-angiotensin-aldosterone system.

ADVERSE SAFETY OUTCOME IN CKD: ACCELERATION OF KIDNEY FUNCTION LOSS

A patient safety event typically is defined as an unintended incident that usually results in a hospitalization, prolonged length of hospital stay, unexpected injury, or death. With CKD, the unintended consequences of a patient safety event must be broadened to include progression of disease. The rate of kidney function decrease associated with CKD is variable. The most sig-