

## The Daily Burden of Acute Kidney Injury: A Survey of US Nephrologists on World Kidney Day

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American Society of Nephrology\*

**Background:** World Kidney Day 2013 focused on raising awareness of the impact and consequences of acute kidney injury (AKI). Although many studies have examined rates of AKI in hospitalized patients, we were interested in the impact of AKI on the workload of nephrologists.

**Study Design:** Cross-sectional forced-choice internet-based survey.

**Setting & Participants:** 598 survey respondents who were US-based nephrologist members of the American Society of Nephrology.

**Outcomes:** Numbers of inpatients and outpatients seen on World Kidney Day 2013 for the management of AKI or other conditions (and specifically in-hospital renal replacement therapies [RRTs]), based on self-report of number/percentage of patients seen on World Kidney Day and in the prior year.

**Results:** Of 598 physician respondents (response rate, 12%), 310 saw patients in the hospital on World Kidney Day. Of 3,285 patients seen by respondents, 1,500 were seen for AKI (46%); 1,233, for end-stage renal disease (37%); and 552, for non-AKI/end-stage renal disease-related problems (17%). Of patients with AKI, 688 (46%) were in the intensive care unit and 415 (28%) received RRT. Intermittent hemodialysis was performed in 315 patients (76%) who received RRT. Delivered dialysis dose was quantified in only 48 (15%) of those receiving intermittent hemodialysis. 260 respondents saw 2,380 patients in the ambulatory setting, of whom 207 (9%) were seen for follow-up of AKI.

**Limitations:** There was a low response rate to the survey. Numbers of patients were self-reported.

**Conclusions:** This is the first physician survey examining the care of patients and impact of AKI on current in-hospital and ambulatory nephrology practices. In our sample, AKI was the most common reason for in-hospital nephrology consultation. Furthermore, our findings point to significant areas in which improvement is needed, including inadequate quantification of dialysis delivered dose. Finally, our survey highlights that AKI is a major public health issue.

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**INDEX WORDS:** Acute kidney injury (AKI); survey; nephrology; dialysis; dialysis dosing; World Kidney Day; epidemiology; workload; public health.

The incidence of hospital-acquired acute kidney injury (AKI) has been increasing over the past several years, with the expectation that rates may double in the future.<sup>1-4</sup> During the past decade, the development of several standardized classification systems and staging criteria for AKI have informed and improved knowledge of the epidemiology and natural history of AKI,<sup>5-7</sup> as well as its potential long-term effects, including the development of

progressive chronic kidney disease (CKD) including end-stage renal disease (ESRD), and increased mortality risk.<sup>8-10</sup> Transitioning the care of hospitalized patients with AKI to the ambulatory clinic setting is poorly studied and fraught with missed opportunities to prevent chronic disease.<sup>11</sup> However, despite these data, the true impact of AKI on the inpatient and outpatient activities of nephrologists has not been quantified previously.

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Several large multicenter trials<sup>12,13</sup> have established the appropriate dose of renal replacement therapy (RRT) for patients with AKI, that is,  $Kt/V_{\text{urea}}$  of 1.3 for thrice-weekly intermittent hemodialysis (IHD) and ultrafiltration rate of 20-25 mL/kg/h for continuous RRT. Several years later, it remains unclear how often nephrologists measure the delivered dose of dialysis during IHD for AKI.

Started in 2006, World Kidney Day is an international initiative designed to convey information about kidney disease to the public, government health officials, and health care providers.<sup>14-16</sup> During the past 7 years, World Kidney Day's themes have included early detection of kidney disease, kidney protection measures such as blood pressure and diabetes control, and kidney organ donation. In 2013, World Kidney Day highlighted AKI to raise awareness and stimulate discussion, education, and policy development to prevent and treat this condition.<sup>17</sup> As part of this global effort on World Kidney Day, we conducted a survey of nephrologists to quantify the workload related to the care of patients with AKI in both hospital and clinic settings and assess adherence to dialysis dosing guidelines.

## METHODS

### Survey and Participants

An anonymous web-based self-administered survey was conducted on World Kidney Day 2013 (March 14), with a sampling frame of all adult and pediatric practicing nephrologists who reside in the United States and are members of the American Society of Nephrology (ASN). The survey was developed by members of the ASN AKI Advisory Group and distributed by the ASN using an online survey tool (SurveyMonkey). Prior to World Kidney Day, 3 e-mail messages (March 7 and 12) were sent by the ASN to US nephrologists announcing the survey. In addition, ASN alerted its nephrologist members to the survey by social media. Finally, the World Kidney Day link on the ASN website also had a survey announcement. Three additional e-mail notifications regarding the survey were distributed to the target audience. The first was the invitation and link to complete the survey (March 14); the other 2 e-mails (March 18 and 23) were reminders to those who had not yet completed the survey.

The survey consisted of 20 questions (Item S1, available as online supplementary material) and was designed to capture characteristics of the respondents, including years since completion of fellowship training, populations treated (adult vs pediatric), type of clinical practice (university vs community hospital, employed in medical group vs self-employed, and number of hospital beds at primary practice location), and scope of practice pertaining to the care of patients with AKI in both acute-care hospitals and ambulatory clinic settings. The survey was aimed primarily at estimating the extent of in-hospital and ambulatory clinical nephrology practice devoted to the care of patients with AKI on World Kidney Day. AKI was defined based on an absolute  $\geq 0.3$ -mg/dL increase in serum creatinine level; no distinction was made between de novo AKI and AKI with pre-existing CKD. Respondents also were asked questions regarding nephrology practice during the past year. The survey questions were designed so that answers were provided as continuous numerical data, categorical data (yes or no answer), or multiple choice (percentage distribution), as appropriate. The survey was

piloted on members of the AKI Advisory Group and further refined through the assistance of a survey specialist (J.A.S.).

Survey participation was voluntary, and respondents could skip questions at their discretion or if they were not applicable. There was no financial incentive to take the survey. Given the anonymous nature of the survey, there was an exemption for consenting survey respondents. The study was approved by the Institutional Review Board of the University of Pennsylvania.

### Statistical Analyses

Continuous variables are reported as median with interquartile range (IQR) due to skewed distribution. Categorical variables are reported as count and percentage. Comparisons between groups were made with the Kruskal-Wallis test for continuous variables and  $\chi^2$  or Fisher exact test for categorical variables. All statistical analyses were performed using SPSS software (version 20; IBM Corp). Differences were considered statistically significant at  $P < 0.05$ .

## RESULTS

### Characteristics of Survey Respondents

Of the 4,957 ASN US-based practicing nephrologists who were surveyed, 598 (12%) completed the survey (Fig 1). Response rates to individual questions varied from 71%-100%. There were 310 (52%) nephrologists who reported seeing patients in the hospital setting on World Kidney Day, whereas 260 (43%) nephrologists reported seeing patients in the clinic setting. Four hundred respondents reported caring for only adult patients; 62, for pediatric patients; and 11, for both; the other 125 did not respond to this question.

Table 1 lists characteristics of survey respondents. Most (35.8%) respondents had completed fellowship training within the past 10 years. Respondents were most likely to work in a teaching hospital (48.8%) or identify their practice as a group of 2 or more physicians (31.3%), but there was wide variation in the type and size of practice setting, with the descriptors of practice type not being mutually exclusive. The median number of hospital beds at the primary practice location of all the respondents was 400 (IQR, 250-600).

### Survey Findings

#### All Respondents on World Kidney Day

On World Kidney Day, respondents saw a total of 3,285 hospitalized patients for a median of 12 [IQR, 5-18] patients (Table 2). There were 1,500 (46%) patients who had AKI, which constituted the most common diagnosis, followed by 1,233 (38%) patients who had ESRD. The other 552 patients were seen for reasons other than AKI or ESRD. In aggregate, respondents saw more hospitalized patients with AKI than ESRD (median of 5 [IQR, 2-8] vs 4 [IQR, 2-7];  $P = 0.002$ ).

Among hospitalized patients seen for AKI, 688 patients were in the intensive care unit (ICU) and 415 patients received RRT. This corresponded to a median of 2 [IQR, 1-4] patients in the ICU and a median of 1 [IQR, 0-2] patient requiring RRT. Among the 315

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