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SPECIAL ARTICLE
Disease management

Nomenclature for kidney function and disease—executive summary and glossary from a Kidney Disease: Improving Global Outcomes (KDIGO) consensus conference

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Abstract

The worldwide burden of kidney disease is rising, but public awareness remains limited, underscoring the need for more effective communication by stakeholders in the kidney health community. Despite this need for clarity, the nomenclature for describing kidney function and disease lacks uniformity. In June 2019, Kidney Disease: Improving Global Outcomes (KDIGO) convened a consensus conference with the goal of standardizing and refining the nomenclature used in the English language to describe kidney function and disease, and of developing a glossary that could be used by journals in scientific publications. Guiding principles of the conference were that the revised nomenclature should be patient-centred, precise, and consistent with nomenclature used in the KDIGO guidelines. Conference attendees reached general consensus on the following recommendations: (i) to use 'kidney' rather than 'renal' or 'nephro' when referring to kidney disease and kidney function; (ii) to use 'kidney failure' with appropriate descriptions of the presence or absence of symptoms, signs, and treatment rather than 'end-stage' kidney disease; (iii) to use the KDIGO definition and classification of acute kidney diseases and disorders (AKD) and acute kidney injury (AKI) rather than alternative descriptions to define and classify the severity of AKD and AKI; (iv) to use the KDIGO definition and classification of chronic kidney disease (CKD) rather than alternative descriptions to define and classify the severity of CKD; and (v) to use specific kidney measures, such as albuminuria or decreased glomerular filtration rate, rather than 'abnormal or reduced kidney function' to describe alterations in kidney structure and function. A proposed five-part glossary contains specific items for which there was general agreement. Conference attendees acknowledged limitations of the recommendations and glossary but considered that standardizing scientific nomenclature is essential for improving communication.

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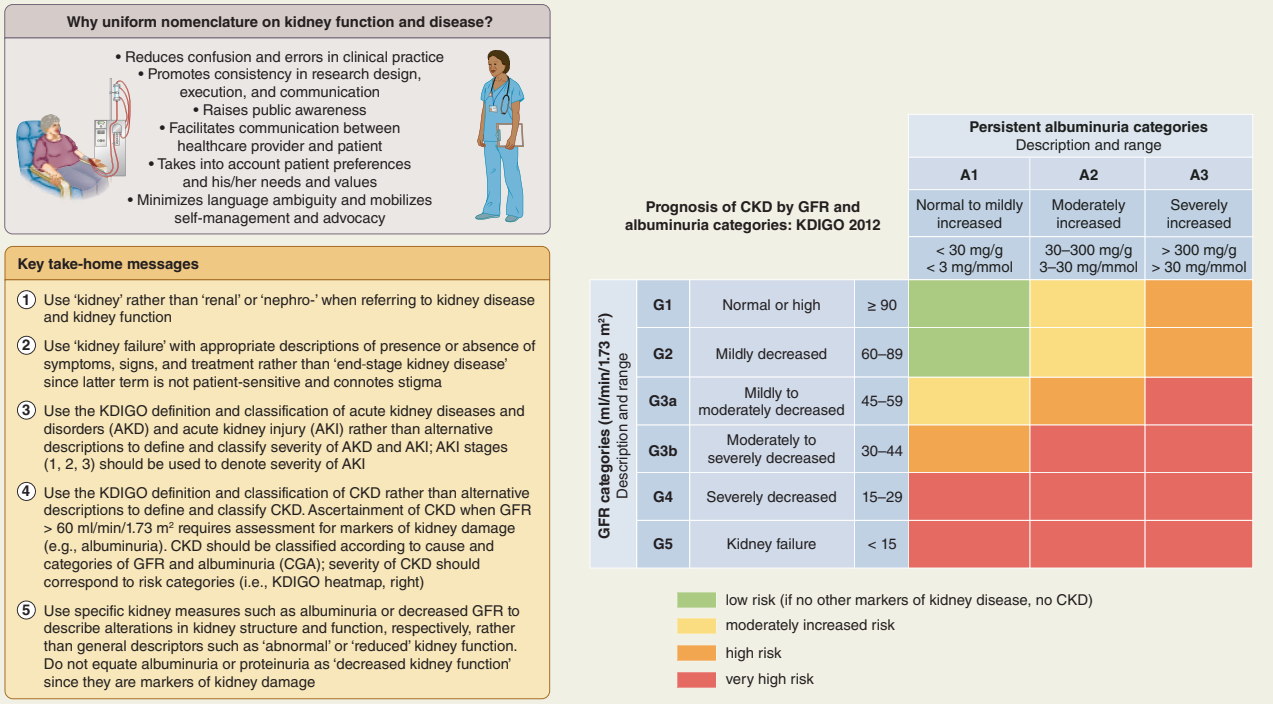
Graphical Abstract



Keywords Acute kidney diseases and disorders • Acute kidney injury • Chronic kidney disease • Kidney disease • Kidney failure • Kidney function • Kidney measures • Nomenclature • Patient-centredness • Precision medicine

A primary obligation of medical journals is the responsible, professional, and expeditious delivery of knowledge from researchers and practitioners to the wider community.[2] The task of journal editors, therefore, rests not merely in selecting what to publish, but in large measure judging how it might best be communicated. The challenge of improving the descriptions of kidney function and disease in medical publishing was the impetus for a Kidney Disease: Improving Global Outcomes (KDIGO) consensus conference held in June 2019. The conference goals included standardizing and refining kidney-related nomenclature used in English language scientific articles and developing a glossary that could be used by journals.[3]

While a glossary of kidney-related nomenclature is most applicable to kidney subspecialty journals, the interdependency of the kidney with other organ systems makes this glossary broadly relevant. For instance, accelerated atherosclerosis was quickly recognized as a complication in patients with kidney failure treated by maintenance haemodialysis,[4] and guidelines have called attention to kidney disease as an independent risk factor for cardiovascular disease for >20 years.[5–13] The Global Burden of Disease Study estimated the worldwide prevalence of chronic kidney disease (CKD) in 2017 to be ~697.5 million people (9.1% of the population), with 1.2 million deaths due to kidney failure, and an additional 1.4 million deaths due to cardiovascular disease (4.6% of total mortality).[14] An earlier report concluded that, in 2013, 'Compared with metabolic risk factors, reduced glomerular filtration rate (GFR) ranked below high systolic blood pressure, high body mass index, and high fasting plasma glucose, and similarly with high total cholesterol'.[15]

The rationale for the 2019 KDIGO conference was that the worldwide burden of kidney disease is rising, but public awareness remains limited, underscoring the need for effective communication by all stakeholders in the kidney health community.[14,16–18] Despite this need, the nomenclature for describing kidney function and disease lacks uniformity and clarity. Two decades ago, a survey of hundreds of published articles and meeting abstracts reported a broad array of overlapping, confusing terms for CKD and advocated adoption of unambiguous terminology.[19] Nevertheless, terms flagged by that analysis as problematic, such as 'chronic renal failure' and 'pre-dialysis', still appear in current-day publications. A coherent, shared nomenclature could improve communication at all levels, including not only to better appreciate the burden of disease but also to aid understanding about how patients feel about their disease, allow more effective communication between kidney disease specialists and other

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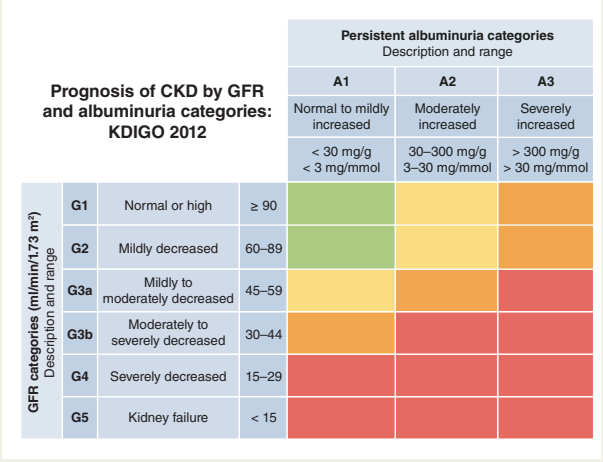

Figure 1 Chronic kidney disease nomenclature used by Kidney Disease: Improving Global Outcomes. Chronic kidney disease is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health. Chronic kidney disease is classified based on cause, glomerular filtration rate category (G1–G5), and albuminuria category (A1–A3), abbreviated as CGA. Prognosis of chronic kidney disease by glomerular filtration rate and albuminuria category is colour-coded as follows: green, low risk (if no other markers of kidney disease, no chronic kidney disease); yellow, moderately increased risk; orange, high risk; red, very high risk. CKD, chronic kidney disease; GFR, glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes.

clinicians, advance more straightforward comparison and integration of datasets, enable better recognition of gaps in knowledge for future research, and facilitate more comprehensive public health policies for acute and CKDs.

Developing consistent, patient-centred, and precise descriptions of kidney function and disease in the scientific literature is an important objective to align communication in clinical practice, research, and public health. While some terms have been in use for decades, the increased exchange of information among stakeholders makes it timely to revisit nomenclature to ensure consistency. The goal is to facilitate communication within and across disciplines and between practitioners and patients, with the ultimate hope of improving outcomes through consistency and precision.

Attendees at the conference included editors of many kidney subspecialty journals, kidney subspecialty editors at high-impact general medical journals and a few journals from other subspecialties, experienced authors of clinical kidney health research, and patients. Guiding principles of the conference were that the revised nomenclature should be patient-centred, precise, and consistent with nomenclature used in the KDIGO guidelines. The discussion focused on the general description of acute and CKD and kidney measures, rather than specific kidney diseases and particular measures of function and structure. Classifications of causes of kidney disease and procedures, performance measures, and outcomes metrics for dialysis and transplantation were considered beyond the scope of discussion.

As described in detail in the conference report,[1] the meeting attendees reached general consensus on the following recommendations for English language medical journals: (i) to use 'kidney' rather than 'renal' or 'nephro' when referring to kidney disease and kidney function; (ii) to use 'kidney failure' with appropriate descriptions of presence or absence of symptoms, signs, and treatment rather than 'end-stage kidney disease'; (iii) to use the KDIGO definition and classification of acute kidney diseases and disorders (AKD) and acute kidney injury (AKI) rather than alternative descriptions to define and classify the severity of AKD and AKI; (iv) to use the KDIGO definition and classification of CKD rather than alternative descriptions to define and classify CKD (*Figure 1, Take home figure*); and (v) to use specific kidney measures, such as albuminuria or decreased GFR, rather than 'abnormal' or 'reduced' kidney function to describe alterations in kidney structure and function (*Table 1*). Accordingly, the proposed glossary contains five corresponding sections and comprises specific items for which there was general agreement among the conference participants (https://kdigo.org/conferences/nomenclature/, Supplementary material online, *Table S1*).[1] For each section, the glossary includes preferred terms, abbreviations, descriptions, and terms to avoid, with the acknowledgment that journals may choose which of the recommendations to implement, and that journal style will dictate when and how to abbreviate terms to be consistent with nomenclature for other diseases.

A guiding principle for the development of the glossary was patient-centredness. The Health and Medicine Division of US National Academies of Sciences defines patient-centred care as '[p]roviding care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions'.[20] One of the 10 general principles recommended for redesign of the health system is that 'Knowledge is shared and information flows freely. Patients should have unfettered access to their own medical information and to clinical knowledge. Clinicians and patients should communicate effectively and share information'. In principle, the terms used to describe kidney function and disease should be understandable to all, with acknowledgment of variation in the level of health literacy. Use of multiple terms with similar meaning can lead to confusion, as can use of terms that forecast the future (such as 'pre-dialysis'), rather than describe the present. However, convergence of multiple names into an accepted set of terms does require that users of the glossary are willing to accept that labels that have been pre-eminent historically, and that may be more familiar or memorable even now, should now be superseded.[21]

Of equal importance to patient-centredness in the development of the glossary was precision, which can generally be defined as exactness or accuracy.[21] How medicine is defined and understood is changing rapidly from a descriptive disease-based categorization in which multiple pathogenetic pathways may be conflated to mechanism-based categorization that will promote more precise management of clinical problems. The latter approach, in which a molecular profile is added to the clinical and morphologic profile, has already revolutionized diagnosis and treatment in oncology. In nephrology, the ongoing Kidney Precision Medicine Project, funded by the National Institutes of Health, seeks to ethically obtain and evaluate kidney biopsies from participants with AKI or CKD; create a kidney tissue atlas; define disease subgroups; and identify cells, pathways, and targets for novel therapies.[22] As has occurred in oncology, it is anticipated that refinements that result in more precise disease descriptions will be incorporated into current nomenclature for

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Table 1 Key takeaways from the conference

- Use the term 'kidney' rather than 'renal' to describe kidney function and kidney disease. In English the terms renal and kidney are still used interchangeably, resulting in different acronyms describing the same condition or status (e.g. ESRD/ESKD and RRT/KRT). It is more likely that patients and the public would understand the terms incorporating the more familiar noun 'kidney', rather than the less familiar adjective 'renal', which is derived from Latin and is labelled as technical in some dictionaries. Although writing guides may generally favour an appropriate adjective over a noun as a modifier, there are high-profile precedents for the use of 'kidney' as a modifier, such as AKI, CKD, and NIDDK (National Institute of Diabetes and Digestive and Kidney Diseases)
- Avoid the term 'end-stage'. Although rooted in US law, the term is not patient sensitive, may connote a stigma, and may discourage advocacy. In the USA, ESRD (or ESKD) is a synonym for receipt of KRT. However, KRT is a treatment rather than a disease. The term 'kidney failure', which is defined as GFR <15 mL/min/1.73 m^2 or treatment by dialysis, is as comprehensive as 'ESRD/ESKD', without suffering from its limitations
- Improve characterization of the full spectrum of kidney failure. Although all patients with kidney failure have GFR <15 mL/min/1.73 m^2 or are undergoing treatment by dialysis, the severity of symptoms varies greatly. We lack terms to describe the severity of symptoms and signs, and yet they are indications for initiating KRT. There are also no common patient-reported outcome measures to describe severity. The term 'kidney failure' in a chronic setting is defined as >3 months, whereas in an acute setting (i.e. AKI Stage 3), it is reserved for a duration ≤3 months. Kidney failure could be further classified according to patient-reported outcomes (symptoms)
- Use more-descriptive terms for treatments for kidney failure. Many patients with kidney failure do not undergo KRT. The terms 'treated' vs. 'untreated' have been used, but this is not consistent with the idea that supportive care is indeed treatment. Furthermore, in some cases, patients choose supportive care rather than KRT; in other cases, they do not have a choice because of lack of insurance or lack of availability. Finally, some patients may not be under the care of a physician at all
- Avoid the use of 'CKD' as a synonym for 'GFR <60 mL/min/1.73 m^2'. CKD includes markers of kidney damage or GFR <60 mL/min/1.73 m^2 for >3 months, so ascertainment of GFR without assessment for markers of kidney damage is insufficient for classification of CKD status when GFR >60 mL/min/1.73 m^2. If chronicity is not documented, it can be inferred on the basis of corroborative clinical data or presumed in the absence of clinical data to the contrary
- Avoid the use of using 'AKI' as a synonym for 'AKD'. AKD refers to kidney diseases and disorders with duration of ≤3 months, whereas AKI refers to kidney diseases and disorders with onset within 1 week
- Use 'CKD GFR and albuminuria categories' and 'AKI stages' to describe disease severity rather than employing ill-defined terms such as 'mild', 'moderate', 'severe', and 'advanced'
- Use the terms 'GFR categories' and 'albuminuria categories' rather than 'CKD stages' when describing the level of GFR and albuminuria in populations without CKD or without ascertainment of both GFR and albuminuria
- Use the term 'risk categories' to describe combinations of G (GFR) and A (albuminuria) categories from the KDIGO heat map (*Figure 1*)
- Use specific terms, such as 'GFR', 'tubular secretion', 'tubular reabsorption', 'albuminuria', and 'proteinuria', rather than general terms, such as 'abnormal' or 'reduced' kidney function, damage or injury, when possible. Because kidney function comprises several functional categories, including excretory, endocrine, and metabolic functions, it should be described as specifically as possible. GFR is closely linked with the excretory function but should not be used as a synonym, because tubular reabsorption and excretion also contribute to excretory function
- When referring to 'decreased or decreasing GFR', avoid the use of different, poorly defined terms such as: 'impaired kidney function', 'renal insufficiency', 'renal dysfunction', 'renal impairment', 'worsening kidney function', and 'kidney function decline'
- When referring to GFR, use descriptive abbreviations (mGFR for measured GFR and eGFR for estimated GFR), with specific notation based on the endogenous filtration markers used (e.g. $eGFR_{cr}$, $eGFR_{cys}$, and $eGFR_{cr\text{-}cys}$). Additional detail can be given in the methods. For mGFR, the methods should describe the exogenous filtration marker (e.g. inulin, iothalamate, iohexol) and clearance method (urinary clearance, plasma clearance). For eGFR, the methods should describe the estimating equation used (CKD-EPI; MDRD study)
- Avoid referring to 'albuminuria' or 'proteinuria' as 'decreased kidney function'. Albuminuria and proteinuria are markers of kidney damage, rather than measures of kidney function
- When referring to albuminuria or proteinuria, avoid the terms 'microalbuminuria' and 'macroalbuminuria/clinical proteinuria'. Use the terms 'moderately increased' or 'severely increased' instead
- When referring to albuminuria and proteinuria, use descriptive abbreviations, such as 'urine albumin or protein excretion rates (AER and PER)' and 'urine albumin-creatinine or protein-creatinine ratios (ACR and PCR)'

ACR, albumin-creatinine ratio; AER, albumin excretion rate; AKD, acute kidney diseases and disorders; AKI, acute kidney injury; CKD, chronic kidney disease; CKD-EPI, CKD Epidemiology Collaboration; eGFR, estimated glomerular filtration rate; $eGFR_{cr}$, estimated glomerular filtration rate derived from creatinine; $eGFR_{cr\text{-}cys}$, estimated glomerular filtration rate derived from creatinine and cystatin C; $eGFR_{cys}$, estimated glomerular filtration rate derived from cystatin C; ESKD, end-stage kidney disease; ESRD, end-stage renal disease; GFR, glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes; KRT, kidney replacement therapy; MDRD, Modification of Diet in Renal Disease; mGFR, measured glomerular filtration rate; NIDDK, National Institute of Diabetes and Digestive and Kidney Diseases; PCR, protein-creatinine ratio; PER, protein excretion rate; RRT, renal replacement therapy; US, United States.

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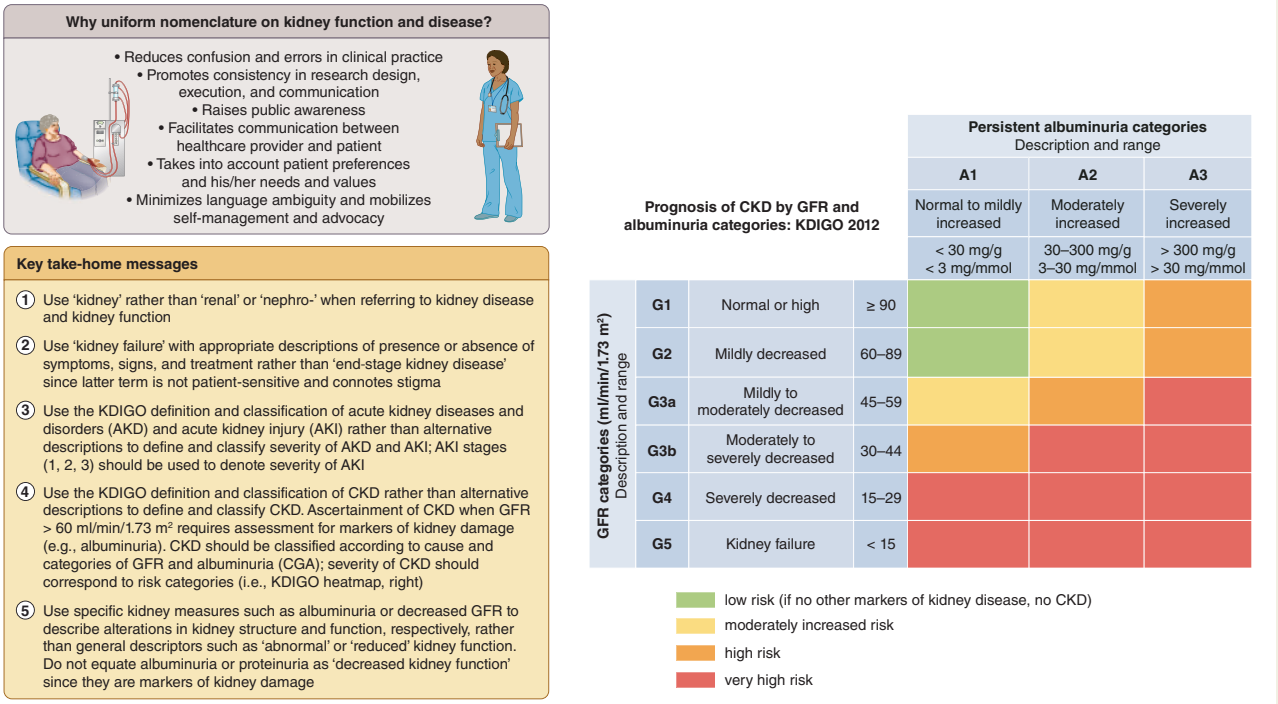

Take home figure Objectives and conclusions of the KDIGO consensus conference on nomenclature for kidney function and disease.

kidney function and disease, rather than replace it altogether. Thus, although the glossary is designed to be consistent with current knowledge and stable enough to remain relevant for the foreseeable future, it is also intended to be sufficiently flexible to accommodate new vocabulary arising with advances in the field.

A central strength of the proposed glossary is that it is based on existing KDIGO definitions, classifications, and nomenclature for acute and CKD. In addition, it was developed using a systematic process, including articulation of a clear and transparent rationale (patient-centredness and precision); capture of stakeholder viewpoints via patient focus groups and a corresponding survey; a period of public comment on conference scope; and attainment of consensus among attendees at the conference. While the recommendations are not likely to answer all concerns, the consensus among conference attendees was that standardizing scientific nomenclature is a necessary first step to improving communications among clinicians, researchers, and public health officials, and with patients, their families and caregivers, and the public.

Limitations of the proposed glossary are that it is restricted to English (nuances may be difficult to translate); only a limited number of stakeholders could participate due to practical reasons; it is not comprehensive (it does not include disease classification, dialysis, transplantation); and further specification will be required for studies in children. For these and other reasons, we consider the current recommendations for a glossary as an important starting point, and it will require future expansion and updating.

Achieving consensus among conference attendees and publication of the conference report and glossary is only the first step in implementation of a revised nomenclature. The glossary will be freely available on the KDIGO website (https://kdigo.org/conferences/nomenclature/) and Supplementary material online, *Table S1*. Elements of the glossary will be included in online updates to the newly released (11th) edition of the *AMA Manual of Style*.[23] Medical journals adopting the recommendations will need to determine how to implement them and this process will require education of editorial staff as well as proactive communication with authors, generally and with regard to specific manuscripts. Translations to languages other than English will be necessary for the selection of preferred terms. If successful, further implementation in clinical practice, research, and public health will require more widespread dissemination and professional education and integration into electronic health records. Introduction of new terms will require revisions to definitions of exposures, outcomes, and adjustment variables in research studies and to revisions to search strategies of bibliographic medical databases. Improving communication with patients and the public will require efforts to improve patient education and health literacy for the public and guides to communication with patients that provide appropriate translation to people with varying health literacy. Professional societies, industry, and patient advocacy organizations will be critical to these efforts.

Advances in research, particularly in precision medicine, will introduce a myriad of new terms and novel concepts requiring incorporation into disease definitions and classifications. In addition, the increasing prominence and participation of patient and caregiver communities in defining research objectives and best practices in clinical care objectives will further elucidate the

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characteristics of patient-centred terminology. Expanding and updating the KDIGO glossary can be accomplished as part of the activities of future KDIGO guideline workgroups and future conferences.

Supplementary material

Supplementary material is available at *European Heart Journal* online.

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