Recommendations for kidney disease guideline updating: a report by the KDIGO Methods Committee

Katrin Uhlig[1], Jeffrey S. Berns[2], Serena Carville[3], Wiley Chan[4], Michael Cheung[5], Gordon H. Guyatt[6], Allyson Hart[7,8], Sandra Zelman Lewis[9], Marcello Tonelli[10], Angela C. Webster[11,12], Timothy J. Wilt[13,14] and Bertram L. Kasiske[7,8]

[1]Tufts Medical Center, Boston, Massachusetts, USA; [2]Perelman School of Medicine at the University of Pennsylvania, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA; [3]National Clinical Guideline Centre, Royal College of Physicians, London, UK; [4]Northwest Kaiser Permanente, Portland, Oregon, USA; [5]Kidney Disease: Improving Global Outcomes (KDIGO), Brussels, Belgium; [6]Department of Clinical Epidemiology and Biostatistics, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada; [7]Division of Nephrology, Hennepin County Medical Center, Minneapolis, Minnesota, USA; [8]University of Minnesota, Minneapolis, Minnesota, USA; [9]EBQ Consulting LLC, Northbrook, Illinois, USA; [10]Department of Medicine, University of Calgary, Calgary, Alberta, Canada; [11]Cochrane Kidney and Transplant and Centre for Kidney Research, Westmead Hospital, Westmead, New South Wales, Australia; [12]Sydney School of Public Health, University of Sydney, Sydney, New South Wales, Australia; [13]Center for Chronic Diseases Outcomes Research, Minneapolis VA Health Care System, Minneapolis, Minnesota, USA; and [14]University of Minnesota, Department of Medicine, Minneapolis, Minnesota, USA

Updating rather than *de novo* guideline development now accounts for the majority of guideline activities for many guideline development organizations, including Kidney Disease: Improving Global Outcomes (KDIGO), an international kidney disease guideline development entity that has produced guidelines on kidney diseases since 2008. Increasingly, guideline developers are moving away from updating at fixed intervals in favor of more flexible approaches that use periodic expert assessment of guideline currency (with or without an updated systematic review) to determine the need for updating. Determining the need for guideline updating in an efficient, transparent, and timely manner is challenging, and updating of systematic reviews and guidelines is labor intensive. Ideally, guidelines should be updated dynamically when new evidence indicates a need for a substantive change in the guideline based on *a priori* criteria. This dynamic updating (sometimes referred to as a living guideline model) can be facilitated with the use of integrated electronic platforms that allow updating of specific recommendations. This report summarizes consensus-based recommendations from a panel of guideline methodology professionals on how to keep KDIGO guidelines up to date.

Kidney International (2016) **89,** 753–760; http://dx.doi.org/10.1016/j.kint.2015.11.030

KEYWORDS: clinical practice guideline; guideline development; guideline updating; nephrology; systematic reviews

© 2016 International Society of Nephrology

Correspondence: *Katrin Uhlig, Tufts Medical Center, 750 Washington Street, Boston, Massachusetts 02111, USA. E-mail: kuhlig1@gmail.com*

Received 18 July 2015; revised 21 October 2015; accepted 12 November 2015

Kidney Disease: Improving Global Outcomes (KDIGO) is a global organization that aims to improve care and outcomes of kidney disease patients worldwide through the development and implementation of nephrology clinical practice guidelines (CPGs). KDIGO has produced 9 comprehensive guidelines since 2008 that cover major areas of kidney disease care. Going forward, updating rather than *de novo* guideline development will constitute the majority of its guideline activities. CPGs need to reflect current evidence to be trustworthy. A critical task for a guideline development initiative is to keep its guidelines up to date and to be transparent about the process by which it can assure their currency. The rate at which guideline recommendations become out of date varies. Some guidelines may remain the standard of care for years after publication, while others might be obsolete within a few months—for example, if a key trial is invalidated due to subsequent study or scientific misconduct, or if a recommended treatment is removed from the market based on postmarketing surveillance.

A number of approaches have been followed for keeping guidelines up to date, but it is not clear how to optimize trade-offs between currency, efficiency, quality, and cost. One approach is to update guidelines at fixed intervals, but this does not allow for timely updating of out-of-date recommendations and can waste resources for updates that may not be necessary. This illustrates the value of a flexible approach that uses periodic expert assessment of guideline currency and ongoing surveillance of emerging literature to support decision making regarding the need for updating.

Deciding whether an update is warranted hinges on the judgment about the potential impact of new evidence on content or strength of existing recommendations. Approaches vary concerning how and by whom this judgment is made. Generally, an in-depth understanding of the quality and quantity of new pertinent evidence (based on updated

systematic reviews and meta-analyses) will provide greater certainty when assessing whether an update is required.

Once a decision has been made to update a guideline, the process for the actual update will depend on what has been done to assess the need for an update. For example, if systematic reviews of new evidence and how it impacts the existing recommendations have already been done, this will reduce the effort for evidence review in the update. If the decision to update rested mainly on expert opinion, then the update will require updating the supporting systematic reviews. Thus, there is a trade-off between committing resources earlier (to better inform the decision whether and what to update) versus later (when the resources can be focused on the evidence reviews and recommendations chosen to update).

While guideline updates can build on the analytic frameworks of existing guidelines, they also need to consider relevant additions, omissions, or alterations to the existing topics; changes to population, intervention, comparator, and outcomes (PICO) questions; safety information; and changes in practice. Thus, the complexity of keeping guidelines up to date should not be underestimated as it requires capacity for ongoing evidence surveillance, expert judgment to identify triggers for updating or necessary changes in guideline scope, and the ability to conduct updates when needed.

Multiple electronic tools can be used to automate labor-intensive steps in systematic review and guideline development.[1] Web-based programs support literature searching and screening, data presentation and synthesis for systematic review, evidence grading, and formatting and writing of guideline documents. While these electronic tools certainly benefit *de novo* guideline development, they are also critical in facilitating updates. Once a new guideline is created as electronically structured content in a database, it can subsequently be kept up to date more efficiently.

KDIGO convened a Methods Committee to advise on a practical and efficient method to keep its guidelines up to date. The KDIGO Methods Committee included members with expertise in systematic review and guideline development from KDIGO, the Kidney Disease Outcomes Quality Initiative (KDOQI), the American College of Chest Physicians, the National Institute for Health and Care Excellence (NICE), the National Clinical Guideline Center, Kaiser Permanente, the Cochrane Collaboration, the Agency for Healthcare Research and Quality, and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group. The committee held regular conference calls from October 2013 through April 2015 and shared documents and manuscript drafts via e-mail. Given KDIGO's current need to update several of its guidelines, the Methods Committee selected guideline updating and maintenance of guideline currency as important areas on which to advise KDIGO. This included consideration of methodology and technology for developing new guidelines as critical determinants for the methods for updating. The committee reviewed existing guideline-updating practices and methods based on a narrative review of literature and input from the committee experts. As KDIGO is committed to following GRADE, the review focused on methods that interface and support GRADE methods steps.[2] The committee also reviewed existing standards on processes and metrics for up-to-date guidelines. Further, it reviewed existing platforms that support guideline updating and explored partnerships for possible collaboration. Finally, it offered recommendations based on the consensus of the committee members.

KDIGO uses several different processes to determine the need for guideline updates. Its Executive Board makes decisions about which guidelines to update. Controversies conferences are also used to vet the currency of its guidelines.[3] Past guideline Work Group Co-Chairs or members may be asked to monitor for new evidence, PICO questions, and important safety information that may not come from randomized controlled trials (e.g., withdrawal of key treatments from the market due to safety concerns).

The guiding principles for guideline updates are identical to those for new guidelines. Guideline entities need to carefully choose, vet, and approve guideline panel members; incorporate stakeholder input; adhere to an analytic framework; formulate focused questions that are addressed by systematic review; and follow transparent processes for evidence synthesis and grading. These principles have been described in various standards for guideline development including those by the Institute of Medicine,[4,5] Guideline International Network,[6] and the GRADE Working Group.[7,8]

The nephrology literature is characterized by a lack of studies that are adequately powered to address clinical end points. As a result, systematic reviews of evidence may not offer clear answers, and evidence interpretation and consensus development remain core activities for the nephrology guideline panel. This highlights the importance of adhering to established guideline development standards to guard against potential bias. KDIGO guidelines span many topics and contain graded recommendations as well as ungraded statements. Graded recommendations are based on in-depth evidence reviews for a PICO question, while ungraded statements are not. The graded recommendations are the focus of this paper, as their updating requires updating of the evidence review.

While this paper is focused on KDIGO guidelines, updating is a challenge for any guideline entity. Therefore the recommendations in this paper are potentially relevant to all guideline developers.

Empirical evidence on durability of guideline recommendations

Empirical studies have found that the durability of guideline recommendations varies. An analysis of NICE clinical guideline recommendations showed that 14% were no longer up to date by 3 years after publication, increasing to approximately 50% after 5 years.[9] A study of class I cardiology recommendations by the American College of

Cardiology and the American Heart Association found that the time from initial publication to an updated guideline ranged from 4 to 10 years.[10] Class I recommendations are strong, definitive recommendations that something should be done. In the updated guideline, 80.0% of class I recommendations were retained in the subsequent version; 8.9% were downgraded, 0.3% were reversed, and 10.8% were omitted. The probability of downgrade, reversal, or omission was higher for recommendations that were based on lower-quality evidence compared to higher-quality evidence (i.e., from multiple randomized studies). Other factors indicating that a guideline may be out of date are newly available diagnostic or therapeutic options, adoption of a new standard of care, safety alerts, and new research insights into the meaning of different end points.[11]

Existing standards for up-to-date guidelines

Several groups have developed standards for guideline methods and commented on how to assess the currency of guidelines and keep guidelines up to date. The Institute of Medicine recommends that the CPG publication date, date of pertinent systematic evidence review, and proposed date for future CPG review should be documented in the CPG.[4] Further, literature should be monitored regularly following CPG publication to identify the emergence of new, potentially relevant evidence and to evaluate the continued validity of the CPG. Finally, CPGs should be updated when new evidence suggests the need for modification of clinically important recommendations. The Institute of Medicine report provides some scenarios that indicate a need for updating, i.e., when new evidence shows that a recommended intervention causes substantial harm; when a new intervention is better than a previously recommended intervention, either in terms of efficacy or harms; or when a recommendation can be applied to new populations. The Institute of Medicine acknowledges that even without new evidence from research studies, guidelines may need to be updated (e.g., if the standard of care has evolved).

The National Guideline Clearinghouse stipulates in its 2013 criteria for inclusion of CPGs that "the guideline must have been developed, reviewed, or revised within the past five years, as evidenced by appropriate documentation (e.g., the systematic review or detailed description of methodology)."[12] Another point of reference for guideline methods is the Appraisal of Guidelines for Research and Evaluation Instrument (AGREE II).[13] It specifies that a procedure for updating the guideline should be provided. Guideline International Network recommends that a guideline should include an expiration date or describe the process that the guideline groups will use to update recommendations.[6]

A recent review shows that the periods most commonly proposed for updating are 2 to 3 years, although guidelines become outdated at different rates.[14] Generally, the process for updating CPGs is poorly described in guideline handbooks. In particular, guidance on the literature search, evidence selection, assessment, synthesis, and external review of the updating process is often lacking. A survey of CPG institutions also showed a lack of standardization and rigor in updating methods.[15]

Current practices to keep guidelines current and up to date

Current guideline developers' methods for updating fall broadly into those that conduct flexible updates based on identified need (e.g., triggered by ongoing evidence surveillance), those that review the decision to update at defined intervals with updates following as needed, and those that update after a fixed interval. An example of the shift to flexible updating is the American College of Chest Physicians' "living guideline model," where targeted recommendations are updated continually in the face of new information that warrants a substantial change to practice.[5,16] Another example is Kaiser Permanente, which evaluates the PICO questions across its portfolio of guidelines by potential clinical impact to prioritize them for ongoing literature surveillance.[17]

Other organizations use a schedule for updates; NICE has implemented an adaptive review process alternating between a limited and a more thorough surveillance every 2 years.[18] The decision-making process for when an update is needed also varies. These differences are explored in more detail in the following section.

Identifying the need to update. Use of explicit criteria as triggers for updating increases the transparency of decision making around guideline updating. Shekelle *et al.* identified 6 situations that might require a guideline to be updated:[11,19] (i) changes in available interventions; (ii) changes in evidence on the benefits and harms of existing interventions; (iii) changes in outcomes that are considered to be important; (iv) changes in evidence that current practice is optimal; (v) changes in values placed on outcomes; and (vi) changes in resources available for health care (Table 1). Shekelle *et al.* emphasized the importance of the first 4 criteria, which relate to identifying when new information on interventions, outcomes, and performance justifies changing a guideline. Changes in the values placed on outcomes (the fifth criterion) occur as societal norms change. Measuring these values and how they change over time is usually too complex to consider explicitly when determining the need for updating. Changes in availability of resources for health care or the costs of interventions (the sixth criterion) may be considered in the context of guidelines for a specific jurisdiction, but usually cannot be assessed for international guidelines such as those by KDIGO, since policymakers and payers in disparate health care systems outside of the guideline group need to consider additional factors when deciding whether services remain affordable.[19]

Overall, a combination of multidisciplinary expert assessment and evidence surveillance is required for a comprehensive assessment of guideline currency.[11] Decision making can be facilitated through use of an explicit grading system. KDIGO follows the GRADE system, which provides a systematic and transparent approach to assessing quality of evidence, and linking evidence to recommendations.

Table 1 | Criteria to determine if a guideline may need to be updated[11,19]

Criterion	Explanation	Example
1. Changes in available interventions (e.g., new drugs or devices)	New preventive, diagnostic, or treatment interventions have emerged to complement or supersede other interventions.	A guideline may need to reflect the new role of a recently approved new treatment.
2. Changes in evidence on the existing benefits and harms of interventions	There is new information about the magnitude of benefits and harms.	A surgical technique may have evolved to be of lower risk, altering the risk–benefit ratio in favor of expanding the target population.
3. Changes in outcomes considered important	New evidence identifies important outcomes that were previously unappreciated or unrecognized.	There may be emerging evidence on quality of life as an endpoint that was not considered as an endpoint in earlier research.
4. Changes in evidence that current practice is optimal	The gap between recommended and current practice has narrowed to the point that a guideline is no longer needed.	A survey of practitioners may show that a prior guideline recommendation has been fully adopted.
5. Changes in values placed on outcomes	Values that individuals or society place on different outcomes have changed over time.	Shifts in economic or ethical values are usually too complex to measure or consider for many guidelines, but can be considered explicitly in national guidelines, such as those developed by the UK National Institute for Clinical Excellence.
6. Changes in resources available for health care or costs of interventions	Available resources have increased or decreased over time.	Changes in resources may be considered in a guideline for a specific jurisdiction. The expiration of a drug patent, for example, could reduce its price through competition and influence guidelines for a therapeutic area.

Grading of evidence and recommendations is usually conducted after literature surveillance and appraisal. However, GRADE also allows a guideline panel to agree on criteria that would warrant an update based on impact on clinical decision making, such as changes in quality of evidence, effect estimates, and the strength and direction of recommendations.

Use of literature review to inform the decision for updating. Several reputable guideline producers base the need to update on systematic literature searches that focus on some or all of the PICO questions from the original guideline. The initial searches may be restricted to high-impact or key journals, and pertinent systematic reviews. For example, Kaiser Permanente conducts ongoing systematic literature searches for each key PICO question—looking for all systematic reviews, and for original studies in high-impact journals. The decision to update is based on the priority of the PICO question, especially if multiple questions suggest the need for an update. Other developers undertake focused searches on all review questions, but include additional input to inform the decision.

Use of stakeholder input to inform the decision for updating. Several producers have mechanisms in place to incorporate input from external stakeholders. Stakeholders may be invited to submit evidence, notify about changes in the evidence base, or alert developers to sentinel events such as US Food and Drug Administration warnings or removal of a product from the market that impact the guideline.

One method used by NICE involves sending a questionnaire to the original guideline development group at the same time as a high-level literature search is undertaken. The combined information gathered from the original guideline developers along with the new evidence is used to determine whether any aspects of the guideline need to be updated. This process follows an adaptive surveillance cycle, with a more thorough approach and stakeholder input every 4 years. At the 4-year surveillance, stakeholders are invited to comment on the proposed update decision during a consultation phase. All stakeholder comments are considered by the surveillance team, and responses to such feedback are publicly available once the final decision to update or not has been made.

Role of the guideline review panel. In many guideline programs, a review panel is assigned the role of determining whether or not a guideline update should go ahead, and what the scope of the proposed update should be. Information gathered from literature searches and stakeholder opinion is presented to an internal team or panel. The panel may have the authority to make the final decision (e.g., NICE) or it may refer the decision to another committee (e.g., the American College of Physicians proposes a topic to the Agency for Healthcare Research and Quality for a new evidence report). The American College of Chest Physicians considers areas in which frontline clinicians and patients (internal or external to the panels) identify a need for guidance while defining the new scope and PICO questions. Processes to address sentinel events or escalate important triggers can differ between organizations; some include this within their standard update review, whereas others (e.g., NICE) have an expedited procedure for rapid updates

in exceptional circumstances that require an urgent change to recommendations.

An example of how to record the decision of a review panel is shown in Supplementary Table S1 online; NICE publishes its assessments once completed. Similar considerations apply across different organizations. Input from a larger stakeholder and expert group may reduce the element of subjectivity (as discussed previously).

Technological platforms to support *de novo* guideline development and updating

As for other major guideline producers, the emphasis and reward for KDIGO have been on new guideline development, and resource constraints often result in delayed updating. Electronic tools that support the repetitive and fatiguing activities in guideline development and updating therefore hold great promise for facilitating dynamic updating. Applications, programs, and electronic platforms can support various steps of systematic review and guideline development, such as literature searches, literature monitoring, screening, record keeping, data extraction, data presentation and table generation, meta-analysis, writing and editing of guideline text, and publishing. A selection of such tools is shown in Supplementary Table S2.[1]

Some tools deserve to be described in more detail as they are customized for guideline development and fulfill core requirements for efficient updating. Guideline updating can proceed with great efficiency if it can seamlessly build on previous work. Therefore, a key requirement for electronic guideline update tools is a centralized database with content organized as structured information components for each recommendation. Each structured information component should include a clinical question of interest in the PICO format, evidence profiles with effect estimates, and recommendations. One platform that provides content in this format is MAGICapp (Oslo, Norway).[20]

Another key requirement is the availability of structured data on evidence retrieval (search strategies, screening, citations), and access to relevant full-text publications and the systematic reviews underlying recommendations. Covidence (Melbourne, Victoria, Australia) is one platform that allows storage of information on duplicate screening and data extraction, while Doctor Evidence (Santa Monica, California, USA) provides digitized data from primary studies. These platforms can be integrated with platforms such as MAGICapp to provide end-to-end support from question formulation to guideline publishing and updating, and the synergistic benefits are shown in Table 2.[20] In addition, their literature surveillance systems can search many more databases than ever before; search filters and PICO can be readily adjusted to accommodate variable thresholds for the literature monitoring (e.g., screen only high-impact journals with a minimum population size or follow-up duration).

Many guideline producers, including KDIGO, rely on print publications to disseminate their guidelines. This is time-consuming, and yields a rigid format that is not conducive to dynamic updating. Online guideline authoring tools and publication platforms may facilitate guideline updates and enhance uptake at point of care while maintaining methodological rigor and transparency. MAGICapp links its structured guideline content to electronic medical records and includes decision aids to inform decision making.[20] In the future, tools like MAGICapp will enable guidelines to cross-reference with various ontologies (e.g., ICD, SnoMed, MeSH) for enhanced integration with electronic medical records or textbooks.

Before selecting a tool, a guideline organization needs to determine the scope of its updating activities and whether it aims to move to dynamic updating. The choice of tool should also consider the needs of the guideline producer (e.g., capabilities, preference for outsourcing, capacity for pilot testing or customization) and weigh the potential benefits of automation against added costs and effort for process change and maintenance. Some programs (e.g., Doctor Evidence) offer services by research analysts for data review and extraction, and data quality assessment, functions for which a producer may otherwise rely on volunteers or its own evidence review team. Guideline developers should also consider the support that will be available for implementing the new tool, as well as compatibility and interoperability of the new tool with other instruments that they may use now or in the future. Given the rapidly evolving nature of these tools, guideline developers should ensure that their data are stored in a structured format that allows exporting and importing across platforms.

Collaboration with guideline development entities in the nephrology domain

Collaboration across guideline entities is critical to enhance efficiency and economy in guideline updating. Guideline producers with similar goals should join in setting priorities and ensuring coverage and currency of important guideline topics. Collaboration can not only avoid unnecessary duplication of effort but also avoid inconsistency across recommendations by different organizations.

For KDIGO, the activities of Cochrane Kidney and Transplant (CKT, previously known as the Cochrane Renal Group) have particular relevance. The CKT produces and disseminates systematic reviews relevant to patients with kidney disease, which are published in the Cochrane Database of Systematic Reviews as part of *The Cochrane Library*. CKT also maintains a specialized register of controlled clinical trials, which is updated daily through systematic searches of citation databases, clinical trial registers, and conference proceedings. CKT's strengths include established processes for evidence surveillance and embedded early warning systems; established systems for classifying evidence and organizing study reports; and a growing number of relevant, high-quality, up-to-date systematic reviews that are mapped to any CPGs they have informed.

CKT has a strong track record of collaboration with other guideline developers, where its support ranges from basic

Table 2 | Benefits of end-to-end electronic platforms or combinations of complementary tools for guideline development and updating

Benefits	Specific comments
Streamlined process resulting in increased efficiency and consistency during evidence retrieval and systematic review	Online platform fosters collaboration in the review team, enabling pooling of efforts for literature review. Uniform data extraction and reporting forms (i.e., data summary tables, evidence profiles) assure consistent data collection and presentation.
Increased transparency in evidence selection	Ability to track and document decision making at every step from document selection, literature review (including reasons for rejection of specific studies), and evidence appraisal; permits automatic generation of PRISMA diagrams.
Increased quality control during systematic review	Potential discrepancies between extractions performed by dual readers and differing opinions on study selection or evidence evaluation can be readily identified for adjudication and reconciliation.
Automation expands scale and ability to maintain currency	Electronic functions enable searching numerous databases in addition to Medline (e.g., Conference Abstracts, Cochrane systematic reviews). New articles are identified and added via a dynamic process at more frequent intervals, hence the potential for quicker or continuous updates.
Centralized content repository and rigorous library management system for evidence retrieval	Central online repository contains all full-text articles reviewed for guideline development and other information relevant for guideline statements (e.g., data from trials, information or warnings from postmarket surveillance, drug recalls, etc.). Multiple publications from a given trial can be properly coded and linked, minimizing confusion and the risk of misclassifying multiple reports as separate trials.
Digitization facilitates evidence surveillance and guideline updating	Data digitization allows updating of systematic reviews with greater ease and informs assessment on how new evidence impacts current recommendations. Priority of clinical questions, search filters, and PICO parameters can be calibrated to match the thresholds for decisions on guideline updating.
Transparency in grading	Use of explicit grading system and linkage between recommendations and supporting evidence provide transparency.
Efficiency in guideline writing	Guideline authoring tool supports authoring, reviewing, and updating of guideline text.
Enhanced implementation and uptake by clinicians and patients at point of care	Electronic guideline platform can link guideline content and decision support tools with electronic health records.

PICO, population, intervention, comparator, and outcomes; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

evidence retrieval to training guideline support staff in question formulation and evidence sorting, appraisal, and summary. CKT has also prioritized review updates and new reviews in line with known guideline group activities, and routinely incorporates GRADE where possible. CKT guideline partners have included the Caring for Australasians with Renal Impairment guideline group and the European Renal Best Practice group (formerly European Best Practice Guidelines). CKT has also provided more indirect support to individuals and groups working on guidelines, including NICE clinical guidelines and National Institute for Health Research evaluation, trials, and studies programs. Given these established links, involving the CKT may also enhance information flow between KDIGO and other entities.

CKT can support KDIGO guideline development with a range of services. On a basic level, CKT can conduct evidence surveillance and retrieval for specific clinical questions and guideline topics and periodically send unfiltered new evidence and "early warning" markers of new evidence from trial registrations or conference abstracts. KDIGO would have to sort and decide whether new evidence was relevant or worthy of triggering an update. Alternatively, CKT can perform the first filter and only forward relevant evidence with potential to trigger review update, while withholding lower-level evidence, or evidence related but not central to the guideline. CKT can further perform some tasks associated with guideline generation such as sorting, organizing, and appraising new evidence, and adding to or creating new evidence tables.

Further economies of effort and reduction of redundancy are likely to be possible through more strategic collaboration with other organizations producing guidelines on topics that overlap with the scope of KDIGO. Collaboration could involve planning guideline updates such that related topics are updated jointly by different entities, and having cross-representation from different entities on update panels to facilitate endorsements. If KDIGO were to endorse or adapt new guidelines from other producers, this would also increase guideline coverage and currency of KDIGO topic areas. This model is used by Kidney Health Australia–Caring for Australians with Renal Insufficiency (KHA-CARI).

Table 3 | Recommendations for keeping KDIGO guidelines up to date

Review of guideline currency and decision making regarding the need to update

1) For each guideline you are planning to keep updated, commission a guideline surveillance group to review the currency of that guideline. Appoint approximately 2–3 content experts, for example former Work Group Chairs or members, or other content experts, and at least 1 methodologist with expertise in evidence appraisal and GRADE approach. Key questions for follow-up should be prioritized in advance, and their respective PICO criteria should be reviewed and revised as appropriate.
2) For each guideline you are planning to keep updated, conduct ongoing literature surveillance for the guideline topics. Consider different approaches to literature surveillance.
   a. Contract an evidence review team to periodically re-execute literature searches in medical databases or set up continuous evidence feeds to identify studies pertinent to the guideline.
   b. Consider contracting with the CKT to obtain citations of RCTs and systematic reviews or articles presorted by relevance for guidelines topics.
   c. Fine tune the search filters and, at a minimum, search for relevant RCTs in high-impact journals.
   d. Search additional databases for regulatory alerts or sentinel events.
3) Periodically (e.g., monthly), feed yield from literature surveillance to the guideline surveillance group.
4) Task guideline surveillance group with periodically reporting (e.g., annually) on the currency of the guideline. The guideline surveillance group is expected to:
   a. Review new evidence and stakeholder input for signals indicating that guideline may be out of date.
   b. Record decisions in categorical response criteria: e.g., reaffirmation with no changes, update of particular section (or PICO, if applicable), or complete update; recommended deletions or additions.
   c. Provide explanation for recommended action: e.g., if update is recommended, explain what has changed and why update is needed.
5) Provide a process for expedited review and guideline updating based on sentinel events or triggers with potentially important impact on safety.
6) Publish assessment of guideline currency from periodic review as an online appendix to each guideline.

Institutional provisions

1) Set up a flexible mechanism to prioritize and authorize updates.
2) Set up resources for updates. More timely updates may require more resources even with greater use of automation and focus of updates.
3) Use Controversies Conferences as needed to evaluate the currency of guidelines and determine the extent of necessary revisions. Consider Controversies Conferences particularly for rapidly evolving areas to identify new topics and questions.

Guideline formatting to facilitate updating

1) Change formatting of guidelines from large comprehensive guidelines spanning multiple topics to content organized as structured information components in which an individual key clinical question or specific recommendation constitutes a unit to allow focused updates of a specific recommendation.
2) Standardize the layout for each guideline information unit and the sequence of evidence tables, summary tables, risk of bias tables, recommendations, and supporting rationale.
3) In guideline updates, include a summary of what has changed and why. Cross-tabulate between the specific old and new recommendations to help clinicians understand changes.

Evaluate, pilot, and invest in electronic tools to enhance currency and quality going forward

1) Assign a committee to choose the best tool(s) of 1 or more organizations that have shown recent innovation and established collaborations to foster compatibility with other systems and platforms so as not to be driven into a proprietary silo.
2) Select tools that accommodate or integrate the GRADE approach and trustworthy guideline standards.
3) Select a Web-based electronic tool that allows dynamic updating of individual recommendations and underlying content (e.g., evidence profiles, rationale, references).
4) Consider adding tools that facilitate other key steps of guideline updating including literature monitoring services and systematic reviews.
5) Ensure that selected electronic tool providers collaborate to harmonize their offerings—through common data models and structured guideline content in electronic databases—to allow import and export (integration) of content and user-friendly interfaces between tools.
6) Ensure that tools for systematic reviews include databases or repositories to house digitized data from studies included in guideline systematic reviews so as to facilitate cumulative updates. Build or contract with existing providers such as Doctor Evidence or CKT.
7) To optimize timely publication and efficient dissemination of updated recommendations at the point of care, choose tools that allow automated publication of guidelines and decision aids in user-friendly multilayered formats online and offline on all devices, and integration of guidelines for clinical decision support systems in electronic medical records.

Methodological modernization

1) Commit to ongoing review and iterative improvement of processes with methods oversight since rapid evolution will require continuous adaptation of methods and technological innovations. Charge a group with representatives from KDIGO and methodologists (all free of conflicts of interest) to review and select processes and tools for piloting or adopting.

CKT, Cochrane Kidney and Transplant; GRADE, Grading of Recommendations Assessment, Development and Evaluation; KDIGO, Kidney Disease: Improving Global Outcomes; PICO, population, intervention, comparator, and outcomes; RCT, randomized controlled trial.

Major guideline entities concentrating on nephrology are the Canadian Society of Nephrology, the European Renal Best Practice group, KHA-CARI, the Kidney Disease Outcomes Quality Initiative (KDOQI), Sociedad Latinoamericana de Nefrología e Hipertensión, and the United Kingdom Renal Association. The approaches of all these groups to guideline development have recently been described with a view to developing a more collaborative approach.[21] There are also other guideline entities with overlapping interests (e.g., hypertension, diabetes, cardiovascular disease) that may permit either joint guidelines or harmonization of recommendations.

Methodological modernization and ongoing quality improvement

Any methodological modernization requires leadership, vision, and decision making beyond day-to-day business. A commitment to keeping guidelines up to date needs to build on an iterative evaluation of workflow and quality improvement. To keep pace with new developments requires the

ability to pilot new approaches, and adopt and apply innovations that are cascaded down by program developers. Thus a guideline initiative needs to invest in ongoing quality improvement and methods adoption. Oversight by methods experts may also be required for assessing new technologies regarding the value added.

Recommendations for KDIGO

Based on the previously mentioned review of current standards, processes, empirical studies, and tools, the Methods Committee recommends that KDIGO move to dynamic updating of recommendations when warranted by new research evidence or other pertinent considerations. Table 3 contains recommendations for keeping KDIGO guidelines up to date by orchestrating a "living guideline" updating effort. In summary, like other guideline producers, KDIGO is shifting its focus from developing new guidelines to keeping its existing guidelines up to date. The escalating demand for quality and efficiency in guideline updates requires a high level of institutional commitment in resources, infrastructure, technology, and governance. The recommendations in this article provide a road map toward this goal.

DISCLOSURE

JSB declared having served on the clinical trial Executive Committee for Amgen; he is presently President of the National Kidney Foundation (NKF) and former NKF Vice-Chair for Clinical Practice Guidelines and Commentaries. SC acknowledged that the National Clinical Guideline Center receives funding from NICE to develop NICE clinical guidelines and reported no additional relevant financial disclosures. WC was formerly Director, Guidelines and Evidence-Based Medicine, and internal medicine physician at Northwest Kaiser Permanente, and reported no additional relevant financial disclosures. SZL is Chief Guidelines Officer at Doctor Evidence. MT is Chair of the Canadian Task Force on Preventive Health Care and reported no additional relevant financial disclosures. TJW declared having received funding from KDIGO to conduct an evidence synthesis report in support of a clinical practice guideline related to living kidney donation. BLK is immediate past KDIGO Co-Chair and reported no additional relevant financial disclosures. KU, MC, GHG, AH, and ACW reported no relevant disclosures.

ACKNOWLEDGMENT

We thank Dr. Per Olaf Vandvik for his valuable input during preparation of the manuscript.

SUPPLEMENTARY MATERIAL

Table S1. National Institute for Health and Care Excellence (NICE) criteria for deciding whether to update a guideline

Table S2. Selected electronic applications to support systematic review and guideline development and updating tasks

Supplementary material is linked to the online version of the paper at www.kidney-international.org.

REFERENCES

1. Tsafnat G, Glasziou P, Choong MK, et al. Systematic review automation technologies. *Syst Rev*. 2014;3:74.
2. Uhlig K, Macleod A, Craig J, et al. Grading evidence and recommendations for clinical practice guidelines in nephrology. A position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int*. 2006;70:2058–2065.
3. Ketteler M, Elder GJ, Evenepoel P, et al. Revisiting KDIGO clinical practice guideline on chronic kidney disease-mineral and bone disorder: a commentary from a Kidney Disease: Improving Global Outcomes controversies conference. *Kidney Int*. 2015;87:502–528.
4. Institute of Medicine. *Clinical Practice Guidelines We Can Trust*. Washington, DC: National Academies Press; 2011.
5. Lewis SZ, Diekemper R, Ornelas J, et al. Methodologies for the development of CHEST guidelines and expert panel reports. *Chest*. 2014;146:182–192.
6. Qaseem A, Forland F, Macbeth F, et al. Guidelines International Network: toward international standards for clinical practice guidelines. *Ann Intern Med*. 2012;156:525–531.
7. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*. 2008;336:924–926.
8. Atkins D, Best D, Briss PA, et al. Grading quality of evidence and strength of recommendations. *BMJ*. 2004;328:1490.
9. Alderson LJ, Alderson P, Tan T. Median life span of a cohort of National Institute for Health and Care Excellence clinical guidelines was about 60 months. *J Clin Epidemiol*. 2014;67:52–55.
10. Neuman MD, Goldstein JN, Cirullo MA, et al. Durability of class I American College of Cardiology/American Heart Association clinical practice guideline recommendations. *JAMA*. 2014;311:2092–2100.
11. Shekelle P, Eccles MP, Grimshaw JM, et al. When should clinical guidelines be updated? *BMJ*. 2001;323:155–157.
12. Agency for Healthcare Research and Quality. 2013 revised criteria for inclusion of clinical practice guidelines in NGC. Available at: http://www.guideline.gov/about/inclusion-criteria.aspx. Accessed July 18, 2015.
13. Brouwers MC, Kho ME, Browman GP, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ*. 2010;182:E839–E842.
14. Vernooij RW, Sanabria AJ, Sola I, et al. Guidance for updating clinical practice guidelines: a systematic review of methodological handbooks. *Implement Sci*. 2014;9:3.
15. Alonso-Coello P, Martinez Garcia L, Carrasco JM, et al. The updating of clinical practice guidelines: insights from an international survey. *Implement Sci*. 2011;6:107.
16. Lewis SZ, Diekemper RL, French CT, et al. Methodologies for the development of the management of cough: CHEST guideline and expert panel report. *Chest*. 2014;146:1395–1402.
17. Kaiser Permanente. Kaiser Permanente National Guideline Program Process and Methodology for Systematic Development of Clinical Practice Recommendations. Methodology document. Oakland, CA: Kaiser Permanente; July 2014.
18. National Institute for Health and Care Excellence. Developing NICE guidelines: the manual. Process and methods guides. Published October 31, 2014; last updated January 21, 2016. Available at: http://www.nice.org.uk/article/pmg20/resources/non-guidance-developing-nice-guidelines-the-manual-pdf. Accessed February 29, 2016.
19. Shekelle PG, Ortiz E, Rhodes S, et al. Validity of the Agency for Healthcare Research and Quality clinical practice guidelines: how quickly do guidelines become outdated? *JAMA*. 2001;286:1461–1467.
20. Vandvik PO, Brandt L, Alonso-Coello P, et al. Creating clinical practice guidelines we can trust, use, and share: a new era is imminent. *Chest*. 2013;144:381–389.
21. Haller MC, van der Veer SN, Nagler EV, et al. A survey on the methodological processes and policies of renal guideline groups as a first step to harmonize renal guidelines. *Nephrol Dial Transplant*. 2015;30:1066–1074.