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Clinical Decision Support in Laboratory Medicine.
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Guest: Dr. Kay Weng Choy from the Department of Pathology at Northern Health in Epping, Australia.

Bob Barrett: This is a podcast from *Clinical Chemistry*, a production of the Association for Diagnostics & Laboratory Medicine. I'm Bob Barrett. Clinical decision support, or CDS, holds significant promise as a tool for improving clinical laboratory test ordering and result interpretation. Laboratorians can play a crucial role in reducing diagnostic errors and improving patient care by integrating CDS into the pre- and post-analytical testing phases. Nevertheless, there are several potential pitfalls, and successful implementation of CDS requires thoughtful development and careful execution.

Highlighting the potential impact of CDS on patient care, the US Food and Drug Administration has recently started to regulate many CDS algorithms as medical devices in an effort to ensure their safety and efficacy. How should laboratorians identify targets for CDS intervention? Once targets have been identified, what best practices should be followed to design and deploy a CDS solution that accomplishes the intended goal? A new Q&A session, appearing in the March 2024 issue of *Clinical Chemistry,* discusses CDS and laboratory medicine, the areas of need, and strategies for the successful implementation of CDS.

In this podcast, we are excited to speak with the moderator of that Q&A article. Dr. Kay Weng Choy is a chemical pathologist in the Department of Pathology at Northern Health in Epping, Australia. His research interests center on the applications of clinical decision support to improve laboratory test utilization. So Dr. Choy, let's get basic first. What is clinical decision support and why did you suggest this topic for a Q&A feature?

Kay Weng Choy: It appears there is currently a lack of a universal definition of clinical decision support. In fact, when this question was posed to our contributors in the Q&A, it's not surprising to receive diverse perspectives on the definition of clinical decision support. However, there are some common themes. Clinical decision support can be defined as a digital health tool or software intended to enhance clinical decision-making related to patient care, diagnosis, and treatment, and it can achieve this by providing clinical knowledge along with relevant patient or other health information.

There are generally three elements: input, decision engine, and output. Now the input may be manually entered by a user or automatically captured from another system such as electronic health record or laboratory information system, patient specific data such as demographics, clinical details, and lab data. The decision engine then applies a logic to interpret the data and this logic may be in the form of a statistical and/or rule-based algorithm. Following data interpretation, a patient-specific output is produced to guide the clinicians in their next course of action. And the output is generally in the form of an alert, a reminder, or suggestion.

In laboratory medicine, clinical decision support may be helpful in the pre-analytical phase such as appropriate test selection, which can address both overutilization and equally important, underutilization of test. It can also address sample collection such patient preparation and sample collection requirements. Now in the post-analytical phase, it can help interpret laboratory results, flag high-risk results or misdiagnosis, and importantly suggest follow-up testing or clinical management.

Now, it may be difficult for clinicians to stay up to date with the new technology and tests and they often do not have time to absorb the high number of guidelines, associated with pathology tests and clinical decision support is a potential supporting tool. This support should ideally be available at the time of the clinician's consultation with the patient, which is either the time that a clinician is requesting a test on the patient's behalf or the clinician is interpreting pathology results to make management decisions for the patient.

I should mention an interesting and useful perspective by one of our co-authors who commented that there is decision support software available for decisions within the pathology lab for analytical, operational, and financial issues, and they serve an ultimate clinical purpose. However, as it does not directly support clinical decisions, it should not be confused with clinical decision support. But in a recent literature review of clinical decision support for laboratory testing, my colleagues and I found there is heterogeneity in the study designs and implementation strategies that may explain the poor outcomes for some of the clinical decision support.

So we think it is timely for a Q&A on clinical decision support for laboratory testing, to gather expert opinions on questions such as, "What are the areas of need in laboratory medicine where clinical decision support may be considered a potentially useful tool?" The strategies for well-developed, well-implemented clinical decision support and ongoing performance monitoring of clinical decision support as well as

last but not least, the major ethical and local laboratory issues concerning clinical decision support.

Bob Barrett: Taking a look at the contributors in the article, they seem to come from very diverse backgrounds. Can you tell us how this diversity was useful in putting together the final article?

Kay Weng Choy: Yes. We are grateful to have managed to gather experts from a variety of background. They include pathologists at tertiary hospital and commercial laboratories. These are practitioners who have implemented clinical decision support at their own institutions, and they have first-hand experience in the successes of clinical decision support deployment and hence, they are able to share lessons gained from this. For example, one of the contributors from the United States recently published on the use of clinical decision support to improve the laboratory evaluation of monoclonal gammopathies. They designed and deployed a targeted clinical decision support alert to educate and prompt providers to order a serum free light chain assay when ordering serum protein electrophoresis testing, to improve compliance with society guidelines, and more importantly, to improve the diagnostic evaluation of patients with suspected monoclonal gammopathies.

During the COVID-19 pandemic, their health system was able to take advantage of the electronic health record knowledge of the patients' symptoms, location, and other clinical factors to deploy real-time algorithmic decision support to support the most appropriate test were ordered for a given respiratory viral workup. As our co-author write in the Q&A, "With increased real-time availability of [electronic health records] data, there are new opportunities for creating highly relevant and patient-specific decision support."

Another co-author to this Q&A is based in Australia and as the director of clinical decision support at a large commercial pathology service, he has extensive experience in the development and implementation of clinical decision support software to improve test requesting. In fact, he has developed software, what they call guideline-based software, that provides clinicians access with an up-to-date repertoire of pathology testing in the context of the clinical needs of the patient according to published clinical guidelines. So not only does he have direct experience in the entire life cycle of an effective clinical decision support, his perspective implementing decision support in a different region of the world has been useful.

Similarly, it's good to hear from a pathologist from Southeast Asia sharing his thoughts on the major ethical and local regulatory issues concerning clinical decision support. Now speaking of regulatory issues, a contributor from Europe

shared their views in the European regulatory context, including the implementation of clinical decision support in the setting of the European medical device regulation and the in-vitro diagnostic regulation. We are also thankful for contributions from a health informatics researcher with experience in the areas of outcome measurement and diagnostic informatics. In the Q&A, this author describes a systematic approach to the evaluation of clinical decision support and we are also reminded that the aims of clinical decision support are to promote the safety and quality of patient care and to deliver cost and efficiency benefits.

Finally, we have managed to secure contributions from a representative from the industry, the software providers. It was useful to hear their views given their first-hand experience configuring clinical decision support software to meet clinical needs including the technical requirements, challenges, and limitations of the software.

Bob Barrett: Could you share with us some recent examples where clinical decision support has been considered a potential solution?

Kay Weng Choy: Yes, some of our listeners may be familiar with a condition called primary aldosteronism, which is a common and potentially curable cause of hypertension. In people with primary aldosteronism, there is autonomous aldosterone secretion by one or both adrenal glands. Importantly, compared with blood pressure match individuals with essential hypertension, those with primary aldosteronism have worse cardiovascular outcomes. Thankfully, targeted treatment of primary aldosteronism, either with surgery or specific antihypertensive drug called mineralocorticoid receptor antagonist, can improve blood pressure control, reduce cardiovascular risk, and reverse end organ damage.

Now, increasing evidence suggests the prevalence of primary aldosteronism is between about 3 and 13% in primary care patients with hypertension. However, despite its high prevalence and associated complications, primary aldosteronism remains largely under-recognized, underdiagnosed, with less than 2% of people in at-risk population ever tested. There is a simple blood test for primary aldosteronism and that is the plasma aldosterone-to-renin ratio which is routinely available in the United States and here in Australia.

However, common antihypertensive drugs can interfere with this test and so does hyperkalemia or low serum potassium, and estrogen-containing oral contraceptive pill. So for accurate test results, a doctor may need to substitute some of the antihypertensive drugs that the patient may be on with those that do not interfere with the test. It is not surprising then that in a recent study of primary care physicians to

understand the low screening rate for primary aldosteronism, it was found that some of the challenges of routine screening for primary aldosteronism were knowledge gaps and the practical limitation of the aldosterone-renin ratio test. Importantly the authors concluded that most of these practical barriers could be addressed by relatively simple education or guidance to increase screening rates for primary aldosteronism.

So I think this is where clinical decision support can be useful, and my colleagues and I have been working on a web-based clinical decision support that aim to assist clinicians in preparing a patient for the aldosterone-renin ratio blood test, including alerting them to the list of interfering medications and those that do not interfere, and optimizing the serum potassium concentration. Now when the test result becomes available, the clinical decision support tool could assist doctors in interpreting the results in a setting of current medications, kidney function, and serum potassium concentration.

Now while we're on the topic of secondary hypertension, clinical decision support may also be useful for the investigations of Cushing syndrome, which is cortisol excess. Society guidelines recommend three different tests, the low-dose dexamethasone suppression test, late-night salivary cortisol, and 24-hour urine free cortisol. The test selection would depend on the patient's medical history and current medication. If a patient was on an estrogen-containing oral contraceptive pill, then one of these tests might not be suitable. So based on specific input from electronic health record or doctor's manual entry or clinical information, a clinical decision support tool could assist the doctors in ordering the most suitable test and later on to interpret the results as they investigate a patient for Cushing syndrome.

Now, Bob, another example if I may, as I mentioned earlier, the serum free light chain assay has improved the diagnosis of monoclonal gammopathies. However, despite Society recommendations, the serum free light chain assay remains underutilized in the initial laboratory evaluation of monoclonal gammopathies as seen in published studies and based on my observation at my own institution. And again, this is where I think clinical decision support alert has the potential to improve compliance with society guidelines and improve the diagnostic evaluation of patient with suspected monoclonal gammopathies.

Bob Barrett: Very interesting, very interesting. Finally, Dr. Choy, what recommendations can clinical chemists and laboratorians offer to people developing new CDS tools?

Kay Weng Choy: We are aware of several sets of guidelines that have emerged to promote successful implementation of clinical decision support. For example, some listeners may be familiar with the five rights of clinical decision support, a framework which states that sustainable clinical decision support provides the right information to the right person in the right intervention format through the right channel, the right time in the workflow. And there's a group in Boston published the 10 commandments for effective clinical decision support, which includes a number of common elements important to success. And more recently, an international collaboration developed a 16-factor checklist for clinical decision support, a 16 factor checklist that is divided in four domains: the clinical decision support context, content, system, and implementation domain.

Now building on these guidelines and checklists, some pathology colleagues and I have started thinking about a framework specific to clinical decision support for laboratory testing. For example, the ongoing performance of clinical decision support for laboratory testing should involve a combination of laboratory and informatics components. In terms of the laboratory component, it is important to ensure the quality of input data and it may require a dedicated set of analytical performance specifications to ensure the consistency of the output. In terms of the informatics component, it is crucial to keep the decision engine up to date and to monitor for unexpected output or trends.

It is also noted in our current job framework that the primary custodian depends on where the clinical decision support resides, for example electronic health records or a laboratory information system. It also depends on the primary party developing or implementing it, as well as the local institutional structure and local regulations. Of note, where laboratory professionals are primarily involved in its set up for areas related to their discipline, they should be responsible for its ongoing performance.

To that end, recently the Royal College of Pathologists of Australasia Informatics Committee and the Asia-Pacific Federation for Clinical Biochemistry and Laboratory Medicine working group for clinical decision support are jointly working on a position statement for clinical decision support in laboratory medicine. By learning from the expert opinions in the Q&A article, the position statement covers the developmental process and characteristics of a well-developed clinical decision support, the evaluation of clinical decision support to ensure safety and efficacy of the developed solution before clinical deployment, strategies to ensure successful clinical decision support, clinical deployment, and measurement of success, monitoring of the ongoing performance of clinical decision support, and last but

not least, major ethical and local regulatory issues concerning clinical decision support.

Bob Barrett: That was Dr. Kay Weng Choy from Northern Health in Epping, Australia. He served as moderate of a Q&A article discussing clinical decision support in the March 2024 issues of *Clinical Chemistry* and he's been our guest in this podcast on that topic. I'm Bob Barrett. Thanks for listening.