Monitoring Patients with Ongoing Reduced Kidney Function

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Chronic Kidney Disease (CKD) is an increasingly concerning worldwide health problem [1]. Our client is a local independently owned pathology laboratory which processes approximately 1200 renal function tests per day from a catchment population of approximately 750,000 people. When our client needed to filter test results for healthy patients out from those that were showing decreased kidney function we decided to create an automated filtering system. With respect to those patients showing less than fully healthy kidney function, we needed to identify which patients needed more active human monitoring due to changes in their circumstances, versus those that were currently stable and could have less active human monitoring.

We have processed each patient's history of test results using *R* to create a single-page pdf document that can then be supplied to the relevant medical staff. The automated system is running in near-real time, as batches of test results are being processed every fifteen minutes.

The document created shows the medical practitioners the patient's history in graphical form, along with some additional information inspired by Shewhart methodology. The standard control chart is presented in conjunction with exponentially weighted moving average and CUSUM charts. A recommendation for the timing of the patient's next renal function test is also given. While all patients who are tested have the graphic-based pdf file created, this is not sent to the patient's general practitioner but is stored in a repository that is available to them and the specialist clinician. We do generate an e-mail message that informs the general practitioner when the patient should next be tested and indicates how the patient's condition is going to be monitored in future. Meanwhile, the specialist clinician is sent a prioritised list of patients whose cases do need more active attention.

The system is implemented in such a way that allows the client's IT team (not versed in *R* or statistics) to make changes to the messages (in textual form) sent to the patient's general practitioner and/or specialist. Any cosmetic changes requested by our client can be implemented in the source code and tested offline, before being transferred over to the implementation server.

Our findings thus far are that our automated filtering has not made a single false negative call, although we do make a higher number of false positive calls as a consequence. Time savings for the clinicians that had to monitor the test results one by one prior to implementation, look extremely promising.

References

[1] Levey, A. S., K. Eckardt, Y. Tsukamoto, A. Levin, J. Coresh, J. Rossert, D. de Zeeuw, T. H. Hostetter, N. Lameire, and G. Eknoyan (2005). Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney international 67*(6), 2089–2100.