

INFORMER and Potassium Values: A system to enhance detection, notification, and action upon a threat to patient safety in the emergency department.

Gary Gaddis¹, Uttam Garg², Mukut Sharma³, Vijay Kumar⁴

¹St. Luke's Hospital of Kansas City and the University of Missouri-Kansas City School of Medicine; ²Children's Mercy Hospital and the University of Missouri-Kansas City School of Medicine; ³Veterans' Administration Hospital, Kansas City, Missouri; ⁴University of Missouri-Kansas City

Background: Quick remediation should occur after critically abnormal potassium levels are detected by the medical laboratory in blood from emergency department (ED) patients. Critical potassium levels can be elevated (“HyperK⁺”) or decreased (“HypoK⁺”). HyperK⁺ and HypoK⁺ can both lead to avoidable patient harm by causing heart rhythm problems, which can be harmful or lethal. Also, Continuous Quality Improvement (CQI) could be enhanced by the creation of an electronic “audit trail” to track these remediations, which involve detection, notification, action-upon, and documentation steps (*D₁-N-A-D₂*). HyperK⁺ and HypoK⁺ are a logical first target to ameliorate inefficiencies of *D₁-N-A-D₂*, because of the frequency of occurrence of these problems in the ED, because the appropriate rapid ED response is clear, and because failures of *D₁-N-A-D₂* can hurt or kill patients. **Hypothesis:** An automated *D₁-N-A-D₂*, plus audit path, can be created, then merged with a to-be-created standing ED order set, to hasten the treatment of HyperK⁺ and HypoK⁺. **Methods:** (1) A standing order set will be adopted, to permit nurses to administer appropriate treatments to patients with either HyperK⁺ or HypoK⁺, without prior physician notification. Oral or intravenous potassium, as appropriate, will remediate HypoK⁺, Administration of insulin plus glucose, calcium, sodium bicarbonate, and sodium polystyrene resin will ameliorate HyperK⁺. Order sets will be created after input from physician and nursing personnel. (Re-obtaining of blood from patients in whom HyperK⁺ is thought to be a false positive result, due to hemolysis of the blood sample, will be permitted). (2) “Electronic loop”: Engineers will create an electronic pathway to enable the rapid electronic notification of appropriate medical personnel, after critical HyperK⁺ or HypoK⁺ have been detected. This will enable and drive nurses to action. Actions can be electronically audited via review of digital Pyxis™ medication administration machine records, matching medication withdrawals for specific patients to specific incidences of HyperK⁺ and HypoK⁺. Time to nurse action will be documented. Data during implementation of *D₁-N-A-D₂* will be compared to prior historical control data, to determine whether the newly created process delivers appropriate care more quickly to patients with critically abnormal K⁺ values. (In addition, it is anticipated that electronic review of laboratory data for the historical controls will reveal total system failures for some patients; some

patients with *HyperK⁺* and/or *HypoK⁺* might not have been treated at all for their potassium abnormality during their time in the ED.) Results: Time to treatment for *HyperK⁺* and *HypoK⁺* patients, and % of patients with *HyperK⁺* and *HypoK⁺* who represent total system failures, before vs. after implementation of the pervasive computing protocol, will be determined. Conclusion: It is anticipated that a pervasive computing environment can be created to facilitate implementation of a standing medication order set, to enable more rapid *D₁-N-A-D₂* after critical values of *HyperK⁺* or *HypoK⁺* are detected in the blood of emergency department patients. Also, this environment will decrease the failure-to-treat rate for critical *HyperK⁺* and *HypoK⁺*.