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## Evaluating the Effectiveness of AKI Prediction Models

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Lecture Note: Evaluating the Effectiveness of AKI Prediction Models The transition toward precision medicine in nephrology has catalyzed the development of numerous predictive models for Acute Kidney Injury (AKI). However, as we move from bench to bedside, the primary challenge is no longer just building a model, but rigorously evaluating its effectiveness in real-world clinical environments. While traditional statistical metrics such as the Area Under the Receiver Operating Characteristic curve (AUROC) serve as a baseline for discrimination, they often fail to capture the nuances of clinical utility. For a model to be truly effective, it must demonstrate high calibration—meaning the predicted probabilities align with actual observed outcomes—and maintain robustness across diverse patient populations through rigorous external validation. In practice, the effectiveness of an AKI prediction model is frequently undermined by "the implementation gap." Even a mathematically superior model can fail if it contributes to alert fatigue, where clinicians are overwhelmed by false positives, or if the model relies on data features that are not available in real-time. Therefore, we must shift our evaluation framework toward Decision Curve Analysis (DCA) to measure "Net Benefit," ensuring that the intervention triggered by a model provides more value than standard care. Furthermore, we must recognize that AKI is a heterogeneous syndrome. Future models must move beyond binary predictions to identify specific sub-phenotypes, integrating longitudinal EHR data with novel biomarkers. Ultimately, the gold standard for evaluating effectiveness remains the impact on patient-centered outcomes; a model is only as good as its ability to reduce the incidence of AKI, shorten hospital stays, or decrease the necessity for renal replacement therapy. As we refine these predictive tools, our focus must remain on the "last mile" of implementation—ensuring that predictive science translates into a

measurable improvement in survival and kidney health.

**Keywords:** Clinical Utility, External Validation, Net benefit