# Detection of High-Risk Patient for Drug Overdose in Renal Insufficiency

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**Abstract and Objective**

*Drug overdose in renal insufficiency is a major source of inpatients morbidity and, even mortality. Traditional drug overdose detection information system requires reference knowledge base (KB). However, KB is hard to build up, and KB maintaining requires much efforts. The purpose of this study is to develop a simple and portable detection algorithm for high-risk patient for drug overdose in renal insufficiency, even without a renal dosing reference KB. The detection model uses support vector machine (SVM) algorithm and requires 7 usual patients' and doctors' information. The model showed 83.81% of accuracy and 0.78 of AUC.*

***Keywords:***

Drug overdose, Adverse drug events, Support vector machine, Renal insufficiency

## Introduction

Adverse drug events (AEDs) are associated with inpatient morbidity, mortality and causes additional costs. Overdosing drug which requires renal dose adjustment is one of medication error and causes renal function impairment or accumulates in a body at excessive concentration [1]. Use of clinical decision support system (CDSS) can reduce renal overdoses. However, KB is difficultly constructed and maintained for CDSS to prevent renal overdoses. And adoption of CDSSs usually requires expensive resources. The purpose of this study is to develop a model detecting high-risk patient for drug overdosing without KB.

## Methods

### Data Extraction

Patient and doctor data were obtained from hospital information system for 48 months between January 1, 2002 and December 31, 2005 from a tertiary hospital. A subset of 431,119 out of 18,981,276 records of prescription data was selected. The creatinine clearance (CrCl) was estimated by the abbreviated Modification of Diet in Renal Disease (MDRD) equation. A renal overdose was identified by comparing the1-day dose of a prescribed drug with the recommend 1-day dose from the renal dosing reference knowledge base.

### Generation and Evaluation of Model

We developed a prediction model to detect high risk patient of overdose using SVM. SVM uses an optional non-linear transformation of clinical variables and maximize predictive accuracy without overfitting. The accuracy of SVM largely depends on the kernel. However, there are no theories concerning how to choose good kernel in a data-dependent way. In this study, radial basis function (RBF) kernel showed best accuracy.

The following 7 variables were selected using multivariate analysis: patient`s age; patient`s sex; patient`s renal function (CrCl); prescribing doctor`s grade; weekly and monthly prescription count of the doctor (representing doctor's workload); doctor`s affiliation (department). High risk patient was defined that they were overdosed drug requiring renal dose adjustment. Holdout method was used to reduce overfitting of the model and to obtain a reliable estimate accuracy. The holdout method randomly split the entire data sample into two independent sets, training (50%) and testing (50%) sets. We computed the area under the ROC curve (AUC) to predict the accuracy of model.

## Results

We applied an independent testing dataset (n = 215,559) to constructed and the proposed model showed 83.81% of accuracy and 0.78 of AUC.

## Conclusion

Considering the situations of small and medium hospitals with less-advanced hospital information system, it isn't easy to build or maintain a KB for renal dosing CDSSs. The proposed prediction model based on SVM can be simply deployed on various hospital information systems to detect high-risk patients for renal overdose, even without any renal dosing reference KB.

## References

[1] Sheen SS, Choi JE, Park RW, Kim EY, Lee YH, and Kang UG. Overdose rate of drugs requiring renal dose adjustment: data analysis of 4 years prescriptions at a tertiary teaching hospital. J Gen Intern Med 2008: 23 (4): 423-8.