Develop a New Clinical Pharmacokinetic Software – JavaPK® for Desktop (JPKD)
建構新的臨床藥物動力學軟體- JavaPK® for Desktop

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Introduction

JavaPK® for mobile devices had been developed for the purpose of clinical therapeutic drug monitoring (TDM) to calculate individual pharmacokinetic (PK) parameters and to assist dosage adjustment for clinicians using Bayesian algorithm. However, there are more limitations for the resource of mobile devices (PalmOS PDA, cellular phone or Pocket PC), such as poor floating points supported in Java micro edition (Java ME). In addition, users cannot define their own models. To solve the problem, we were motivated to redesign a new software which not only preserved all functions of previous JavaPK® for mobile devices, but incorporated with an user's interface to define their own models using population PK parameters.

Methods and Materials

We use Java Standard Edition (Java SE, v1.4.2) as our programming language. Individual PK parameters can be estimated by two algorithms: Sawchuk-Zaske method which uses two sampling concentrations at steady-state to calculate individual PK parameters in aminoglycosides and vancomycin; and Bayesian estimation algorithm which provides a method for only one sampling concentration. Three additional drugs are added for this function. In the users' defined model, we use a Java mathematical expression parser to parse all users' defined equations. Each model divides into three parts: (1) input variables (e.g.. sex, age, body weight, height, serum creatinine, and etc..), these variables are used to define all population PK parameters (*see* part 2); (2) PK parameters: such as *Cl*, *Vd* or others. These PK parameters are expressed as equations using input variable as defined in part (1); and (3) Cs (concentration obtained at a certain time of *t*): this dependent variable (can be drug plasma concentration or observed pharmacological effect) is defined using previous defined PK parameters as previously defined in part (2). Automatically error checking functions were also built to guide users step by step.

Results and Discussion

We name this new software as JavaPK® for Desktop (JPKD). JPKD has been successfully created and it can be run on MS Windows, MacOS X and Linux OS or any other Java SE-supported platform. In addition to original seven drugs built-in mobile edition, we added another three drugs (carbamazepine, lithium and theophylline) for TDM in JPKD. With JPKD, users can define a new drug model based on population PK study. The model can be edited and run to estimate PK parameters by Bayesian algorithm. In this part, the function of dosage adjustment is not included because most situations are to process a batch of data for the purpose of estimating individual PK parameters in all subjects. When users execute a defined model, a spread sheet is provided to estimate large data. The calculated results of JPKD can be saved as .pdf or .csv format.
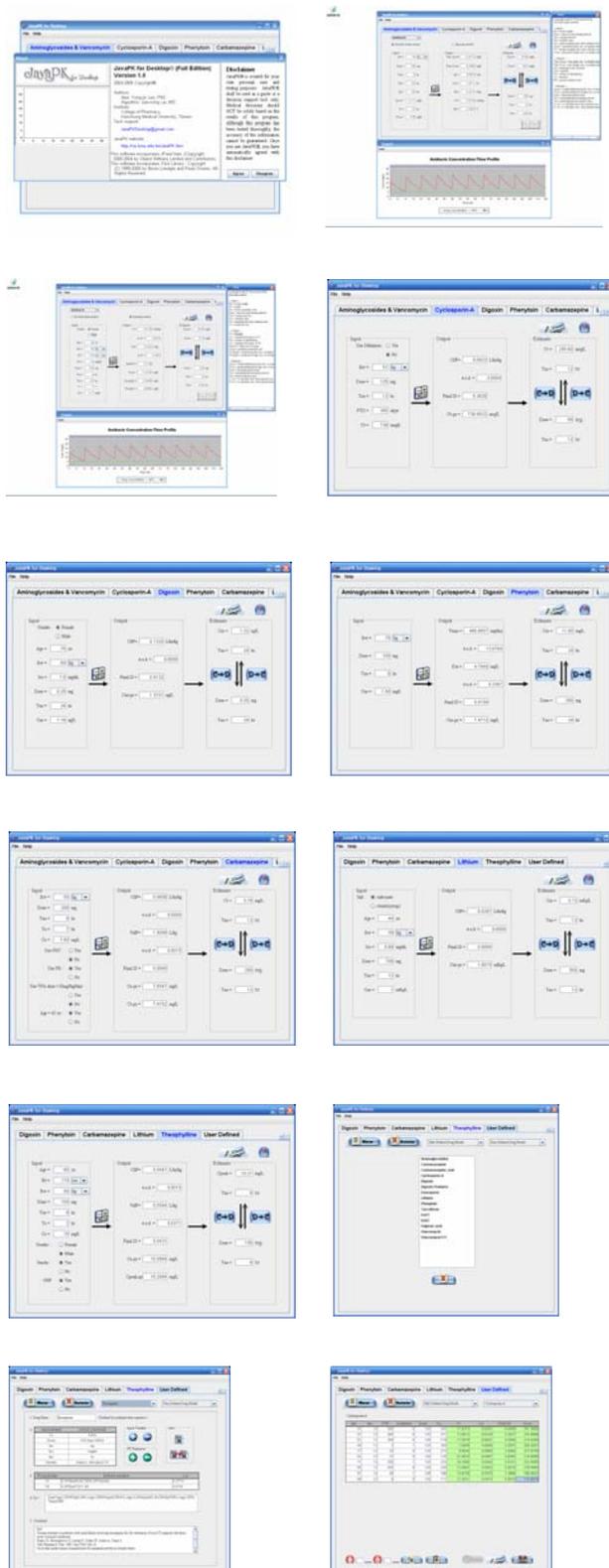
Conclusion and Future Works

In summary, JavaPK® for desktop is a very easy-to-use and powerful tool for TDM services. JPKD will be released at the end of year 2005, and will be able to be downloaded from its website http://ce.kmu.edu.tw/JavaPK.htm as a donaware. More drugs, such as immunosuppressants (tacrolimus and sirolimus) and anti-HIV drugs (PIs) may consider to include in JPKD.

Keyword: population pharmacokinetics, Bayesian algorithm, JavaPK, mathematical expression parser, Java, therapeutic drug monitoring, TDM

References

1. Yamaoka K, Nakagawa T, Tanaka H, Yasuhara M, Okumura K, Hori R, 1985, A nonlinear multiple regression program, MULTI2 (BAYES), based on Bayesian algorithm for microcomputers. *Journal of Pharmacobio-Dynamic*, 8: 246-56.
2. Sawchuk RJ, Zaske DE, 1976, Pharmacokinetics of dosing regimens which utilize multiple intravenous infusions: gentamicin in burn patients. *Journal of Pharmacokinetics and Biopharmaceutics*, 4:183-95.
3. JEP Website, 2005, http://www.singularsys.com/jep/
4. JFreeChart Website, 2005, http://www.jfree.org/jfreechart/index.php
5. iText Website, 2005, http://www.lowagie.com/iText/

All Screenshots of JavaPK® for Desktop