

Design and Implement a Clinical Pharmacokinetic Software for Mobile Devices – JavaPK

在移動裝置上設計與開發臨床藥動學程式 - JavaPK

Sheng-lung Yu (余聲隆), Yung-jin Lee (李勇進)

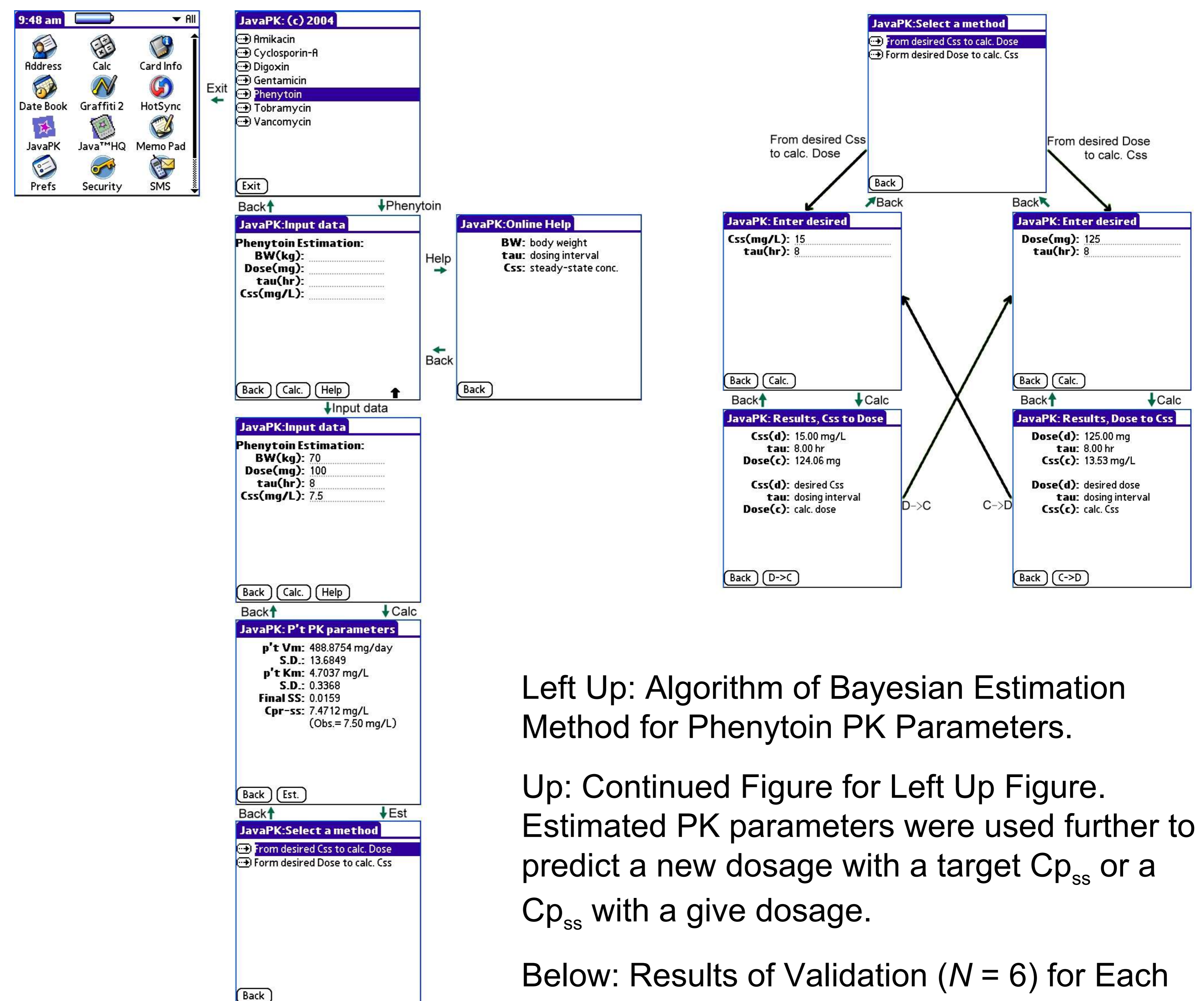
Graduate Institute of Pharmaceutical Sciences
College of Pharmacy
Kaohsiung Medical University
Kaohsiung, TAIWAN 807

Introduction. A clinical pharmacokinetic-oriented software was designed and implemented to assist clinical pharmacists in providing therapeutic drug monitoring (TDM) services. The softwares used in TDM are required that (1) it should be able to cover as more drugs as possible; (2) it should be portable or mobile as needed; and (3) Bayesian estimation algorithm should be implemented in pharmacokinetic parameters estimation for individuals.

Methods & Materials. We used J2ME (JDK v5.0, <http://java.sun.com>) as the programming language and Sun's Wireless toolkit (WTK, v2.1) as compiler. A popular method, Sawchuk-Zaske method, was designed to calculate two aminoglycosides (gentamicin and amikacin) and vancomycin PK parameters. This method requires at least two blood samples (peak and trough C_p or near). Bayesian estimation method was based on Multibayes (Yamaoka, *et. al.*, 1986) algorithm. Mutlibayes was written in BASIC, and was ported to Java in JavaPK®. Bayesian method was designed to estimate PK parameters of digoxin, aminoglycosides (gentamicin and amikacin), vancomycin, phenytoin and cyclosporin-A using only one single blood sample. Simulated data were used to check prediction error (%PE) for each drug.

Results and Discussion. JavaPK® can run on any PalmOS-based PDA and java-supported cellular phones. JavaPK® is the first clinical PK software running on mobile phones. PE was less than 6% (the following Table). Application of JavaPK® in phenytoin is especially useful since phenytoin exhibits nonlinear PK properties. With only one single blood sample, it can accurately estimate both V_{max} and K_m values. As indicated in Table 1, and also using contour plot estimation (Vozech *et. al.*, 1981), it concludes that JavaPK® does very good estimation in phenytoin PK parameter estimation. JavaPK® of trial version can be downloaded from the website of <http://clinpharm.kmu.edu.tw/JavaPK.htm>.

KEYWORD: clinical pharmacokinetics, Bayesian, Sawchuk-Zaske, mobile devices, PDA, JavaPK



Left Up: Algorithm of Bayesian Estimation Method for Phenytoin PK Parameters.

Up: Continued Figure for Left Up Figure. Estimated PK parameters were used further to predict a new dosage with a target $C_{p,ss}$ or a $C_{p,ss}$ with a give dosage.

Below: Results of Validation ($N = 6$) for Each Drug PK Estimation; all %PE are less than 6%.

%PE	GENTA	VANCO	DIGOXIN	Cys-A	%PE	PHENYTOIN
Cl	-4.64	3.71	6.03	0	V_{max}	-3.57
Vd	5.04	-0.594	-	-	K_m	-5.34
C^*	2.47	-2.08	-4.24	0	C_{ss}	5.16

*: gentamicin (genta) & vancomycin (vanco): drug concentration at a certain time during steady-state (C_s).
digoxin: drug concentration at a certain time during steady-state (C_{ss}).
cyclosporin-A (Cys-A): trough concentration at steady-state (C_t).
%PE: mean percentage of prediction error ($N = 6$).
-: not used in the model.

