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Purpose
The purpose of the current research is to a) demonstrate the application of parallelized Grid search method along with optimization methods such as Nelder-Mead, Gauss-Newton methods for the robust estimation of pharmacokinetic and Pharmacodynamic parameters using twenty four plasma concentration-time/Concentration-Time/Time-Response profiles and b) compare the performances of parallelized Grid search method on GPU versus non-parallelized Grid search method on CPU.

Methods
a) Parallelized Grid search method on GPU with hardware configuration, NVIDIA GPU C2075 Tesla GPU.
b) Non-parallelized Grid search method on CPU with hardware configuration, Intel® Dual-Core™ i5-2520M CPU @ 2.50GHz 2.50 GHz, 4 GB Ra., 32-bit Windows 7 OS.
c) Nelder-Mead method.
d) Gauss-Newton method.
e) Algebraic PK-PD models and

Results
1. Parallelized Grid search method on GPU provides extremely fast and robust estimates of PK-PD parameters in the case of twenty four, known PK-PD models that fall into the classes such as a) twenty four, single and multi-compartmental models b) seventeen algebraic and seven differential equations models c) fourteen Pharmacokinetic and ten Pharmacodynamics models and d) models with five to seven parameters.
2. The parallelized Grid search method on GPU is shown to be extremely efficient than the non-parallelized Grid search method on CPU: the observed performance improvements in the case of a) five parameter models are in the range of 169 to 2450 times between GPU Vs CPU. b) six parameters is the range of 475 to 1287 times between GPU Vs CPU. C) seven parameters models is in the range of 230 to 960 times between GPU Vs CPU.

Conclusion
In conclusion, a) we have shown for the first time that Parallelized Grid search method on GPU is a potential approach for the estimation of PK-PD parameters and it dramatically increases the performance. b) The approach can be extended to other PK-PD parameters estimation algorithms and expected to provide performance improvements.