Introduction:
Can an anesthesiologist predict how a patient will react after anesthetic administration? How variable can the patient reactions be? Past research on pharmacokinetic and pharmacodynamic models predict the dose-response relationship. Through computer simulations on we aim to show the variability, consistency, and distinguishability of the dose-response relationship.

Methods:
1000 PK/PD parameter sets were created using the model reported distributions. The sample dosing scheme; propofol infusion of 100 mcg/kg/min, remifentanil infusion of 0.2 mcg/kg/min, two fentanyl boluses of 2 mcg/kg, and propofol bolus of 2 mcg/kg. The infusions were administered for 90 minutes, the first fentanyl bolus was administered at t=0 minutes, the propofol bolus was administered at t=3 minutes, and the second fentanyl bolus was administered at t=75 minutes. PD models were assumed clinical surrogacy for predictors of consciousness, laryngoscopy, pain, and ventilatory depression.

Results:
The PK/PD variability at induction was small while during emergence the variability was large. We have created a movie illustrating the variability which can be viewed online at https://www.dropbox.com/sh/lrzosr7qt6norj9/rCQ2WQL7ys#/. Prediction consistencies at induction were high but dipped during emergence. Overall the ability to change post-anesthetic responsiveness, pain, and intolerable ventilatory depression for remifentanil was poor while propofol and fentanyl were moderate.

Discussion:
Through PK/PD simulation we found there is considerable variability and low consistency within the dynamic range while outside the dynamic range there is small variability and high consistency. This may indicate that to ensure no response amidst inter-patient variability anesthesiologist typically overdose patients.