Project 1: Pain Medication Treatment

Team Presentations: **Wednesday, February 8** and **Friday, February 10**

As soon as we take medication, the body begins to absorb it, and the concentration of the drug in the blood stream increases quickly. The body also begins a slower process of eliminating the drug from our body. Therefore, the concentration of the medicine in the blood is constantly changing; first it goes up quickly and then decreases slowly.

For a person to benefit from a medication, the concentration must be above the Minimum Effective Concentration (MEC) (usually measured in milligrams (mg)); see Figure 1. However, a concentration above the Maximum Tolerance Concentration (MTC) (mg) is considered harmful. For this reason it is important to maintain the amount of medicine between the MEC and the MTC.

Suppose that you are a consultant for a hospital and you help determine the drug dosage amount (mg) and frequency of administration (how often a patient should take a pill) in treatment plans. Doctors can prescribe pills that have the same amount of medicine in each of them.

Consider three different patients that the doctors have determined will take pain medication after a surgery over the course of at maximum one week. Patient #1 will be prescribed oxycodone, Patient #2 will be prescribed ibuprofen, and Patient #3 will be prescribed a combination of oxycodone and ibuprofen. Determine an optimal treatment plan for each patient.

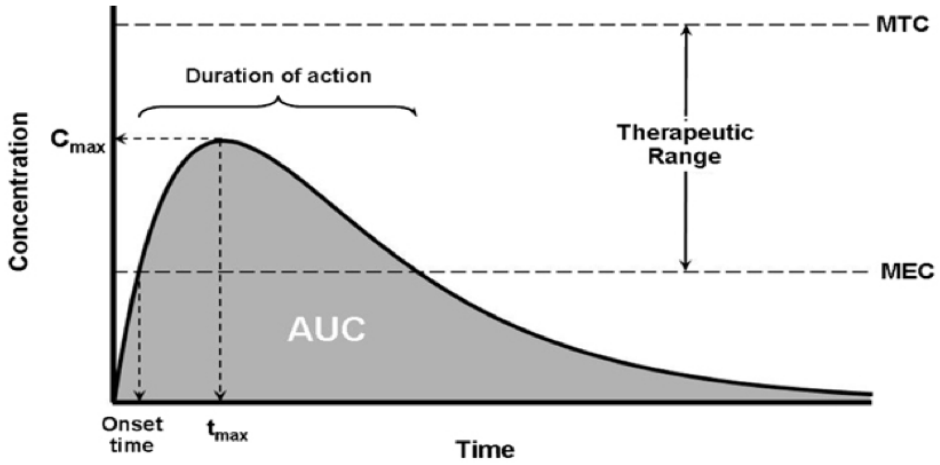

Figure 1: *Pharmacokinetic parameters describing a typical time profile of drug concentration within the blood plasma after administration of medication. C_{max} is the maximum drug concentration; t_{max} is the time to C_{max}; AUC is the area under the curve; MEC is the minimum effective concentration; and MTC is the maximum tolerated concentration. Figure source: The role of pharmacokinetics and pharmacodynamics in phosphodiesterase-5 inhibitor therapy by N. Mehrotra, M. Gupta, A. Kovar, and B. Meibohm, doi: 10.1038/sj.ijir.3901522.*