Pipeline Physics Produces Profit

Abstract

Executives who manage drug development use pipeline models to estimate costs, profit, and productivity, and to inform decision-making. One common pipeline model assumes downstream attrition rates are independent of upstream attrition rates, but theory and empirical evidence suggest this model may be wrong. This study introduces a new pipeline model and shows how the evaluation and selection of preclinical, phase I and phase II compounds affect phase III's attrition rate. Using data from multiple large pharmaceutical companies, the study empirically tests the model and measures, a posteriori, each phase's (1) ability to distinguish marketable compounds (safe and effective) from unmarketable ones, (2) false-positive and false-negative rates and (3) percent of evaluated compounds that are marketable. Using the model and measurements, the study performs several analyses, including a sensitivity analysis and a benchmarking study, to identify opportunities for improving drug development. Additionally, the study develops a pipeline simulation so executives can experience and practice managing Bayesian pipelines.

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