Jonathan Lowden, Rachael Miller Neilan* (rachael.neilan@gmail.com) and Mohammed Yahdi. Optimal control of vancomycin-resistant enterococci using preventive care and treatment of infections.

The rising prevalence of vancomycin-resistant enterococci (VRE) is a major health problem in intensive care units (ICU) because of its association with increased mortality and high health care costs. We present a mathematical framework for determining cost-effective strategies for prevention and treatment of VRE in the ICU. A system of five ordinary differential equations describes the movement of ICU patients in and out of five VRE-related states. Two control variables representing the prevention and treatment of VRE are incorporated into the system. The basic reproductive number is derived and calculated for different levels of the two controls. An optimal control problem is formulated to minimize VRE-related deaths and costs associated with prevention and treatment controls over a finite time period. Numerical solutions illustrate optimal single and dual allocations of the controls for various cost values. Results show that preventive care has the greatest impact in reducing the basic reproductive number, while treatment of VRE infections has the most impact on reducing VRE-related deaths. (Received December 11, 2013)