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Model of Quarantine Implementation in An Animal Shelter for Canine Distemper Outbreak

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Canine distemper virus (CDV), similar to the human measles virus, is an extremely contagious virus that can cause outbreaks in dense canine populations such as shelters. Previous models of CDV in animal shelters have shown that by euthanizing animals at a high rate and testing the population swiftly shelters can prevent or reduce outbreaks. The current study was motivated by previous models to show that quarantining dogs, implementing a foster system, and euthanizing, when necessary, can also reduce outbreaks in animal shelters. Previous models incorporated euthanasia but have not addressed the vital impact of quarantining and optimization on population safety and virus control. The spread of CDV was modeled by a system of ordinary differential equations through S (susceptible), V (vaccinated), E (exposed), I (infected), Q (quarantined), and R (recovered) classes. We use optimal control theory, based on Pontryagin's principle, and numerical simulations to study the impact of quarantining to reduce euthanizing and the spread of disease within shelters.