

Mitigating Zoonotic and Animal Disease Risks in 4-H Animal Science Projects through Coordinated Education and Research

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National and state agencies and institutions have identified bio-security related to animal agriculture as a high priority (e.g., CDFA, 2013; UC ANR, 2009; USDA APHIS, 2010). Backyard farms can serve as sources of pathogens (WHO, 2006), and since most 4-H project animals are raised in backyard settings they represent bio-security risks (Smith & Meehan, 2012). Furthermore, 4-H youth commonly exhibit project animals at public venues, settings where disease outbreaks involving animals (e.g., Moore et al., 2010; USDA APHIS, 2011) and humans (e.g., LeJeune & Davis, 2004; Steimuller et al., 2006) have been reported. Of program and policy relevance, recent studies have shown bio-security risks and the presence of fecal-borne pathogens associated with livestock exhibits at California fairs (Roug et al., 2012; Smith & Meehan, 2012).

Recent outreach efforts from the Veterinary Medicine Extension and California 4-H have focused on youth scientific literacy within the HFC Initiative through bio-security education (Smith et al., 2011; Smith & Meehan, 2013). Specifically, the Bio-Security Proficiencies Program for 4-H, which was developed with grant funds from CDFA and field tested with funding from the Western Center for Risk Management Education, has been shown to improve youth's conceptual understanding of bio-security, advance their competencies related to skills associated with best practice, and support risk mitigation on home premises and at public venues (Smith & Meehan, 2013). However, to date, no research has been conducted that connects participation in bio-security education programs with documented reductions in microbial presence and load in private or public animal environments.

The goal of this project is to apply best practices in youth science education along with laboratory-based assessment techniques to demonstrate the efficacy of the Bio-Security Proficiencies Program for 4-H on the bio-security and disease risk knowledge and skill of youth participants, as well as pathogen loads in home farm and exhibition settings where youth house project animals. In addition, this project will use an epidemiologic approach to determine risk factors for fecal shedding of zoonotic pathogens in exhibition settings, and to recommend associated best management practices (BMPs) to reduce future exposure risks.

The project's design includes three (3) phases. In phases 1 and 2, youth participants will be recruited by collaborators at the local level and assigned to either the treatment or comparison group. The treatment group will participate in the Bio-Security Proficiencies Program for 4-H Youth (Smith & Meehan, 2013), a multi-week intervention facilitated by adult 4-H volunteers who will receive professional development and on-going support. The comparison group will not receive an education intervention. We will compare the two groups with respect to the presence and load for zoonotic fecal borne organisms such as *E. coli*, *Salmonella*, *Campylobacter*, *Cryptosporidium*, and *Giardia*, indicators of overall health of animal environments (Siembieda et al., 2011). These assessments will occur at the home premise (Phase 1) and within their assigned animal area on the first and final days of their participation at the fair (Phase 2). In addition, all youth will participate in assessments of their bio-security and disease risk knowledge and skills. Statistical comparisons of change in microbial load, and content and skills knowledge over time between the two groups, will be conducted. Focus group interview data will also be collected from the treatment group.

Phase 3 methodology will involve evaluating risk factors for fecal shedding of zoonotic pathogens in exhibition settings. Biological data will be collected to test for prevalence of fecal pathogens, change in microbial levels over the course of the fair, and antibiotic resistance of specific organisms. Survey data will be collected to inform the risk factor database; multi-variable modeling will be utilized to determine the relative strength of each identified risk factor in its association with fecal shedding of zoonotic pathogens.

Taken together, the results of this project will inform policy development with respect to bio-security standards within 4-H programs and animal exhibitions in California, as well as at a national level. In addition, the results of the project will be utilized to strengthen education and outreach efforts designed to minimize disease risks associated with the raising and showing of livestock by young producers with the goals of enhancing food safety and protecting human and animal health in an integrated fashion. The project team has demonstrated expertise in all aspects of the proposed program including implementation of the Bio-Security Proficiencies Project at the county level, collaboration with fair managers, and environmental and fecal sample testing for microbial prevalence. The project team is composed of campus and county-based academics and program staff, as well as state-level stakeholders.