

Influenza Education among Youth in Agriculture Pilot Project
Ohio Department of Health
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Developing ‘swientists’ through interactive zoonotic disease risk and mitigation training

Description of public/animal health problem in Ohio

Pigs play a critical role in the ecology and epidemiology of influenza A viruses (IAV) and IAVs in swine are a potential threat to animal and public health. The ongoing and rapid IAV evolution occurring in swine can result in novel IAV strain generation, which if zoonotic transmission and sustained person-to-person transmission occurs, may result in epidemic or pandemic disease. The bidirectional interspecies transmission of these zoonotic viruses typically requires close contact which can occur at various swine-human interfaces. Agricultural fairs create a unique interface that is conducive to zoonotic influenza transmission by commingling pigs and people for a prolonged period of time.

Zoonotic transmission of influenza A viruses between pigs and people has been reported periodically worldwide but has recently received considerable publicity following the H3N2 variant influenza A virus (H3N2v) outbreaks of 2011-2016. The H3N2v outbreak of 2012 became the largest variant IAV outbreak since the 2009 H1N1 pandemic. The investigations into the reported human cases of H3N2v during the 2012 outbreak revealed that 95% of the cases reported direct or indirect contact with swine and 93% of the cases recounted attendance at an agricultural fair within four days of illness onset (Jhung et al., 2013). The majority of 2012 H3N2v cases were youth exhibitors and others in close contact with pigs at the fairs and with nearly 150 million people attending agricultural fairs each year, the potential risk to public health is high.

Ohio public health officials documented 107 (35%) of the human H3N2v cases during 2012, second only to Indiana. These Ohio cases were epidemiologically linked to 14 different agricultural fairs across the state and resulted in 11 hospitalizations and one fatality ("Influenza A (H3N2) variant virus-related hospitalizations: Ohio, 2012," 2012). Comparison of genomic sequences of the H3N2 isolates recovered from humans and exhibition swine in Ohio during 2012 revealed nucleotide identities of > 99.7%, which confirmed zoonotic transmission of influenza A (H3N2) virus between pigs and people at Ohio fairs (Bowman et al., 2014). Additionally, the molecular evidence indicates that one H3N2 IAV strain was widely circulating among Ohio's exhibition swine during 2012.

To date, the bulk of the variant influenza A cases have been youth swine exhibitors which corresponds with serologic studies showing that youth have the highest risk of infection with H3N2v. This is particularly concerning as we consider the prominent role of youth agricultural education programs (4-H and FFA) in the fairs. Agricultural education programs such as 4-H and FFA serve as a way to introduce youth to swine production and establish an interest in the industry. Reducing influenza transmission at fairs is crucial to both agriculture and public health in Ohio.

Ohio is unique in the ability to study these issues; an active IAV surveillance program was established in 2009 to monitor the pigs at agricultural fairs and stock shows. The results of this ongoing project indicate that, on an annual basis, approximately 25% of Ohio fairs have pigs shedding IAV by the conclusion of the fair (Bowman, Nolting, Nelson, & Slemons, 2012). Within those fairs where there are pigs shedding IAV, the estimated prevalence of IAV infection in the swine population is >66%, indicating the viral burden in these settings is high. Furthermore, the majority of IAV infections among swine at the fairs are subclinical, making it difficult to identify and remove infected animals. Additionally, in 2016 surveillance in swine jackpot shows was executed to gain insight into the origins of IAVs circulating in the swine at fairs. Becoming immersed in show pig culture gave investigators a new perspective on the gaps present in current educational programming. Specifically, investigators learned that education needs to reach the influential exhibitors in order to have large-scale buy-in and positive behavior changes.

Resources:

A multidisciplinary team with senior-level leadership has been assembled within the state of Ohio. This team is committed to educating youth participating in agricultural organizations on the prevention, control, public health impacts of zoonotic IAV transmission. Clearly, Ohio felt the effect of zoonotic IAV transmission during 2012. Those events helped build strong relationships among and public and animal health stakeholders and this project will allow us to strengthen further those partnerships to address a topic important to both sectors.

Ohio Department of Health:

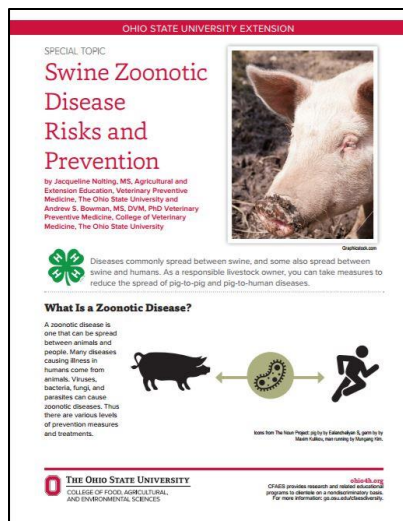
The Ohio Department of Health (ODH) is a cabinet-level agency within Ohio's executive branch that works to carry out the mission of public health in the state. Partnerships with over 100 county and city health departments across Ohio allow ODH to provide much needed public health leadership and services throughout the state.

Dr. Tatham serves as the supervisor of the vaccine preventable disease epidemiology program at the Ohio Department of Health within the Bureau of Infectious Disease; this program conducts surveillance and investigation for various infectious diseases, including influenza. Previous collaborations between ODH and The Ohio State University's Animal Influenza Ecology and Epidemiology Research Program (AIEERP) investigating the 2012 H3N2v outbreak in Ohio have resulted in two peer-reviewed publications (Bowman et al., 2014; Bowman, Sreevatsan, et al., 2012). In addition, ODH, AIEERP and many others were involved in the investigation of an outbreak of influenza A(H3N2) variant virus infections among fair attendees in 2016 (Schicker et al, 2016). For this project, Dr. Tatham will serve as the primary project coordinator. In addition to coordinating all project deliverables, she will confirm that public and animal health messages are developed in conjunction with CSTE, CDC, and USDA.

Ohio 4-H Youth Development:

4-H began in Clark County, Ohio and Ohio is proud of its early 4-H heritage. Ohio's 4H programs are among the largest in existence today. More than 83,000 Ohio youth are currently enrolled members of 4-H community clubs. Ohio's swine program is strong with greater than 12,000 youth participating in a market hog projects annually and another 600 youth completing a breeding swine project each year.

All 4-H programs focus on active involvement and quality experiences, which stimulate lifelong learning of values and skills. Knowledge and mastery of the science of genetics, nutrition, management, handling, and environment in relation to the youth's food animal projects plays a critical role in the



success of producing safe and wholesome food products for consumers. Therefore, the Ohio Department of Agriculture (ODA) mandates that all youth exhibiting food animal projects participate annually in quality assurance programming. OSU Extension provides the leadership for implementing quality assurance programs, in partnership with agricultural education and agricultural societies. These mandated quality assurance programs are the target for implementing scenario-based training of youth exhibitors to mitigate IAV transmission at agricultural fairs. Dr. Miller is an Assistant Professor, 4-H Youth Development Specialist for Companion and Small Animals Programs. Dr. Miller provides leadership to companion and small animal programs, including 4-H PetPALS; coordinates state and regional companion and small animal training opportunities; provides leadership to and assists with companion and small animal curriculum development; and provide leadership to Ohio State Fair companion and small animal activities.

The Ohio State University's Department of Agricultural Communication, Education, and Leadership:

The mission of The Ohio State University's Department of Agricultural Communication, Education, and Leadership (ACEL) is to prepare educators, communicators, and leaders in the food, agricultural, and environmental sciences to integrate research-based information through learning, practice, and engagement, in ways that will advance positive changes that strengthen individuals, families, and communities. ACEL is known to be among the best in the country for equipping students to become talented educators (in public schools and in non-school settings), communicators, and leaders who can address the needs, opportunities, and challenges of a changing world in the areas of food science, environmental science, and agriculture.

ACEL faculty co-investigator, Dr. Specht will bring her expertise in the area of developing grade-appropriate educational curriculum and evaluation procedures to this grant. In addition, ACEL has strong ties to OSU Extension and ODA, including 4-H Youth Development and FFA. These partnerships will be important for fostering the project's goal of educating youth swine exhibitors to prevent IAV transmission. An ACEL student assistant is targeted to assist with the development of educational material and evaluation process.

The Ohio State University's Animal Influenza Ecology and Epidemiology Research Program:

The Animal Influenza Ecology and Epidemiology Research Program (AIEERP) has conducted active surveillance for swine-origin influenza A viruses (IAV-S) at Ohio county fairs since 2009 and various swine jackpot shows since 2016. The collaborative relationships built with fair officials during those years will allow for continued growth of research projects within the fair settings.

To date, the majority of the education has focused on 4-H and FFA agricultural fair exhibitors. The exhibitor targeted educational materials that have been provided to fairs have been well received and additional efforts have been welcomed. AIEERP's surveillance efforts have been primarily funded through the National Institutes of Health's Centers of Excellence for Influenza Research and Surveillance (CEIRS) network, allowing for a long-term investigation into the ecology of IAV-S at county fairs. These surveillance activities have also had gift-in-kind support from the United States Department of Agriculture (USDA) at various levels. A strong collaborative network between ODA, ODH, USDA, and AIEERP was built during the 2012 H3N2v outbreak. The Council of State and Territorial Epidemiologists, in conjunction with the Centers for Disease Control and Prevention recently funded a validation study to determine the effectiveness of policy recommendation to shorten the length of time pigs are on exhibit at fairs. Anticipated continued funding for IAV-S surveillance in the fair settings will allow AIEERP staff direct access to fair directors, extension educators, and swine exhibitors. Since strong relationships already exist, and education is welcome, challenges to completing this proposed project should be minimal. The data stream from the IAV-S surveillance projects will allow AIEERP to assess the impact that the educational activities proposed herein have on IAV prevalence in exhibition swine, which provides Ohio with a unique outcome assessment.



Dr. Bowman will serve as the IAV-S subject matter expert for the team and review the developed education materials for accuracy. Jacqueline Nolting manages the laboratory operations within AIEERP and leads the group's outreach and educational efforts. Ms. Nolting will coordinate project deliverables and provide technical expertise to the student assistant.

Ohio Department of Agriculture:

ODA seeks to protect Ohio citizens by ensuring the safety of the state's food supply, to maintain the health of Ohio's animals and plant life, and to create economic opportunities for Ohio's farmers, food processors and agribusinesses. ODA is the regulatory agency within Ohio with jurisdiction over all livestock exhibitions. Dr. Forshey is the state animal health official for Ohio and is the Chief of the

Animal Health Division within ODA. ODA staff has regular communications with all fairs. Ohio law mandates that each exhibition have an official veterinarian who has been approved by ODA to enforce the laws and regulations of Ohio and inspect the livestock for evidence of any contagious or infectious disease. Within the State of Ohio, all market and lactating animal exhibitors must attend or complete a quality assurance program annually in order to exhibit an animal at a fair. ODA has worked closely with OSU Extension for the implementation of this mandate. ODA has also formed an Advisory Committee on Livestock Exhibitions, a board on which Dr. Bowman currently serves.

Previous related collaboration

To increase awareness among youth swine exhibitors regarding the risks associated with IAV infected swine, scenario-based training exercises were developed and implemented in 2015 by this study team. These materials have been shared with youth on several occasions and have been disseminated to educators across the state. Additionally in 2016, social media platforms were used to disseminate information to youth across a larger geographical area and curriculum describing zoonotic diseases and their risks was developed for the Ohio Swine Resource Handbook.

Methods:

Scenario-based training exercises were developed and implemented in 2015 to increase awareness among youth swine exhibitors regarding the risks associated with IAV infected swine. Social media platforms were used to disseminate information to youth across a larger geographical area and curriculum describing zoonotic diseases and their risks was developed for the swine resource handbook. Although these activities have been shown to be successful in disseminating information by measuring significant gains in knowledge, they only target youth (≤ 18 years of age) involved in agricultural organization such as 4-H and FFA. Many of the youth involved in showing pigs at jackpot shows are not involved in these agricultural organizations because these shows are independent swine exhibitions open to all swine producers to advertise the quality of animals they produce and do not have stringent age limits for showmen.

The development of interactive learning activities based on constructivist learning theories are proposed to increase awareness of the animal and human health risks associated with IAVs circulating in the exhibition swine for these jackpot showmen. This project would expand current efforts to encompass not only all of Ohio, but the national show circuit participants to increase impact. It is hypothesized that educating youth swine exhibitors will result in animal husbandry behavior changes thus decreasing the number of documented H3N2v cases. Reducing the transmission of IAVs between pigs and people at swine shows will allow exhibition traditions to continue while improving animal and human health.

Specific Objectives:

1. Enrich and expand the social media campaign to increase mass awareness of zoonotic diseases and measures to minimize transmission.
2. Pilot incentivized “Becoming a Swientist” programming with OH-pigs Ohio Summer Show Circuit participants
 - a. Host interactive kick-off training session in the beginning of the show season
 - b. Collect and disseminate healthy habit selfies throughout the show season
 - c. Wrap up awards ceremony at the OH-Pigs Annual banquet
3. Initiate an interactive presence at World Pork Expo to build rapport at the national level with swine jackpot show participants

Training materials developed during the previous iterations of this project by these and other state investigators will be used at state and national events to provide direct education to youth. A variety of programming types will be used to disseminate information to youth building awareness and eliciting

behavior changes. Leading change is a delicate process requiring time and resources to be used to gain trust and confidence in the proposed mitigation recommendations.

Objective 1: Enrich and expand the social media campaign to increase mass awareness of zoonotic diseases and measures to minimize transmission.

Objective 1: Methods

The ACEL research team is undertaking a survey of Ohio 4-H youth and county extension educators to analyze their social media habits, preferred platforms, and potential barriers to social-media content consumption. This information will guide the team in the development and scheduling of the social media messages for the 2017 fair season.

Ohio 4-H Youth Development has already established a strong social presence. For this aim, the AIEERP and ACEL teams will develop seven unique social media messages, one for each day of the week prior to each of the 2017 Ohio agricultural fairs, including seven multimedia messages incorporating audiovisual content. These short yet informative messages will be distributed on a statewide basis each week of the fair season using Facebook and Twitter. In addition to the state level distribution, targeted postings will be made to the counties (local agricultural societies, county Extension offices, local 4-H clubs and FFA chapters, etc.) that have fairs occurring during corresponding week of the fair season. Messages will also be shared on stakeholder's social media pages to encourage communication between agencies. Local educators will be encouraged to share the messages with their local youth. These messages will focus on improving awareness and knowledge of zoonotic diseases, including zoonotic disease transmission and prevention. Additionally, the team plans to highlight careers in public and animal health.

Social scientists increasingly study social media, or "Internet-based applications that...allow the creation and exchange of User Generated Content" (Kaplan & Haenlein, 2010), as a means of enabling behavior change within groups of individuals. Social media are inexpensive, easily accessible, and ubiquitous: In 2015, nearly two-thirds of American adults logged into a social networking site (Perrin, 2015).

According to Pew Research Center, nearly one-quarter of U.S. teenagers are almost constantly online (Lenhart, 2015), and two times that number go online at least once daily. Teenagers' geographic location has little impact on their access to the Internet: 89% of rural teens have access to a desktop computer, 68% have access to a smartphone, and 55% own or operate a tablet computer.

Teenagers use the Internet for a variety of activities; among the most popular is using social media. "Teens are enthusiastic users of social media sites and apps...[T]hree-quarters (76%) of teens use social media, and 81% of older teens use the sites, compared with 68% of teens 13 to 14" (Lenhart, 2015). Facebook, Instagram, and Snapchat comprise young adults' most-used social networking platforms. Based on these statistics, social media represent a channel by which Extension educators and other 4-H personnel can disseminate information to young online audiences.

Social media are often used to augment traditional public relations or information campaigns (Kaplan & Haenlein, 2010). So-called "social marketing campaigns" encourage positive behavior or attitude change through the use of social media (Freeman, Potente, Rock, & McIver, 2015). Freeman et al. suggest that social marketing campaigns "could be much less resource intensive and potentially less risky than investing money" in traditional media campaigns (Freeman et al., 2015). Small-scale social marketing campaigns allow communicators to test message content, format, and delivery at minimal cost. In 2017, the project will leverage social media video content in addition to text- and photo-based messages. According to TechCrunch, in 2015 Facebook alone generated more than 8 billion daily video views among its 500 million users (Contine, 2015, November 4).

Dr. Specht brings a wealth of social media experience to the team. She and her student assistant will lead the social media aspect of this project. In addition to utilizing social media in her research, Dr. Specht was formerly the social media coordinator for the Texas A&M Center for Food Safety and currently monitors social media for the Ohio State Food Waste Collaborative.

Objective 1: Evaluation

Data aggregators or social-media monitoring platforms are often employed to collect and analyze large amounts of user-generated information. Faculty members in the ACEL use Sysomos Media Analysis Platform (MAP) to monitor social media conversations surrounding agricultural and environmental issues, including water quality, food safety, and popular media coverage. Data accessible via Sysomos MAP includes social media content from Twitter, Facebook, Instagram, LinkedIn, Tumblr, and other platforms; news media stories and related user commentary; and Web log posts and comments. The platform identifies social media content using keyword searches, hashtags, and individual users; the resulting data can then be sorted according to a variety of characteristics. While a one-year license for Sysomos MAP, which can be shared by multiple users, costs \$20,000, we are able to leverage another project to cover the majority of the cost of this software.

Sysomos MAP will be used to monitor public Facebook, Twitter, and Instagram pages containing project-related messages created by the research team. Using the platform, the team will be able to identify popular message content and format; pinpoint message characteristics that contribute to popularity; track messages' reach in both breadth (number of initial shares or retweets) and depth (number of repeated shares or retweets); and determine which platforms are best suited for sharing zoonotic disease-related information.

Objective 1: Expected Outcomes

Contemporary information provided through social media timed with the start of each county fair will be a very impactful way of educating youth in agriculture. Given the timing of these messages, they are more likely to result in immediate behavior change, and thus lessen the opportunity for exhibitors to become infected with IAV-S. The targeted youth will also have an increased awareness and knowledge of careers in public and animal health.

Objective 2: Pilot incentivized “Becoming a Swientist” programming with OH-pigs Ohio Summer Show Circuit participants

Objective 2: Methods

To date educational programming conducted by investigators has been targeted at youth swine exhibitors participating in agricultural organizations. Although these activities have been shown to be successful in disseminating information by measuring significant gains in knowledge, they only target youth involved in 4-H and FFA. Many of the youth involved in showing pigs at jackpot shows are not involved in these agricultural organizations. Jackpot shows are independent swine exhibitions open to all swine producers to advertise the quality of animals they produce and do not have stringent age limits for showmen. Transitioning to animal care strategies that reduce the risk of zoonotic disease transmission with these youth can be beneficial as they are exposed to swine and their diseases on a regular basis. In addition, these youth and their parents are often leaders of the swine associated activities the local level because of their vast experience. Developing an incentivized educational program to share knowledge with these youth could be a driver in transitions leading to behavior changes.

Interactive training at the beginning of the jackpot show season will be held in conjunction with show activities. Approximately 200 participants will be introduced to a selection of zoonotic diseases that infect swine; transmission routes; and strategies to reduce transmission occurrences. Youth will be asked to submit photo documentation, in the form of selfies, to a private online portal to document the practice of healthy habits for which they will be earning points toward winning prizes. These photos will be shared through university social media platforms, if respective participants give assent. To further participants' knowledge base, there will also be points awarded for the completion of The Center for Food Security and Public Health's *Excellence in Exhibition: Preventing Disease in Animals and People* online training course. Upon completion of face-to-face and online training modules, and documentation of healthy habits for the duration of the show season, prizes will be awarded and youth will be deemed

“Swientist” at the annual OH-Pig banquet. A logo will be developed and used in promotional materials to identify programming leading to the Swientist designation.

Objective 2: Evaluation

Process evaluation will be completed at the end of this pilot to determine the applicability of the program to a national audience. Participants will be asked to complete an evaluation form during the awards banquet to gather their perceptions on the content of the interactive training session, the method by which photo documentation is collected, and the overall design of the program.

Outcomes will be evaluated by using a survey being conducted as part of a surveillance effort funded by National Pork Board, which is being implemented to gauge the perception and compliance with mitigation recommendations described in the *Measures to Minimize Influenza Transmission at Swine Exhibition*. Content of the educational tools being incorporated in the Becoming A Swientist program are directly related to the above mentioned document, therefore understanding the compliance and behaviors of Ohio swine jackpot participants will lend insight into the effectiveness of the proposed educational initiative. In addition, descriptive analysis of the number of participants and their level of engagement will provide further evidence of the efficacy of the program.

Objective 2: Expected Outcomes

Swientists will not only have background knowledge in the risks associated with zoonotic disease, but will have demonstrated behaviors compliant with risk mitigation. They will become leaders in the exhibition swine community as more novice exhibitors mimic their healthy habit behaviors, thus influencing change on a broader-scale.

Objective 3: Initiate an interactive presence at World Pork Expo to build rapport at the national level with swine jackpot show participants

Objective 3: Methods

The expansion of programming proposed in objective 2 to a national audience in coming years is the long term goal of this study team. In order to gain trust and build rapport with youth involved in swine jackpot shows across America, a vendor booth will be hosted at the 2017 World Pork Expo (WPX) in Des Moines, Iowa. More than 500 youth from over 20 states bring market and breeding pigs to participate in this highly competitive show. WPX is the pinnacle of the summer show circuit and success at this competition defines the Who’s Who of the show pig industry.

Entering the booth will require a stop at a portable hand washing station before crossing the clean/dirty line to receive a frozen treat. Educational materials developed by partners from various states will be included in a static display. In addition, there will be a technology station where participants can complete an online *Excellence in Exhibition: Preventing Disease in Animals and People* module developed by Iowa State. An additional interactive station will have content related to swine IAV surveillance and biosecurity issues, with activities varying each day. Potential activities include, but are not limited to, GloGerm, how viruses spread, how to collect a nasal wipe, and how samples are tested demonstrations. Activities will be organized in a manner to attract repeat visits from youth throughout the week.

Objective 3: Evaluation

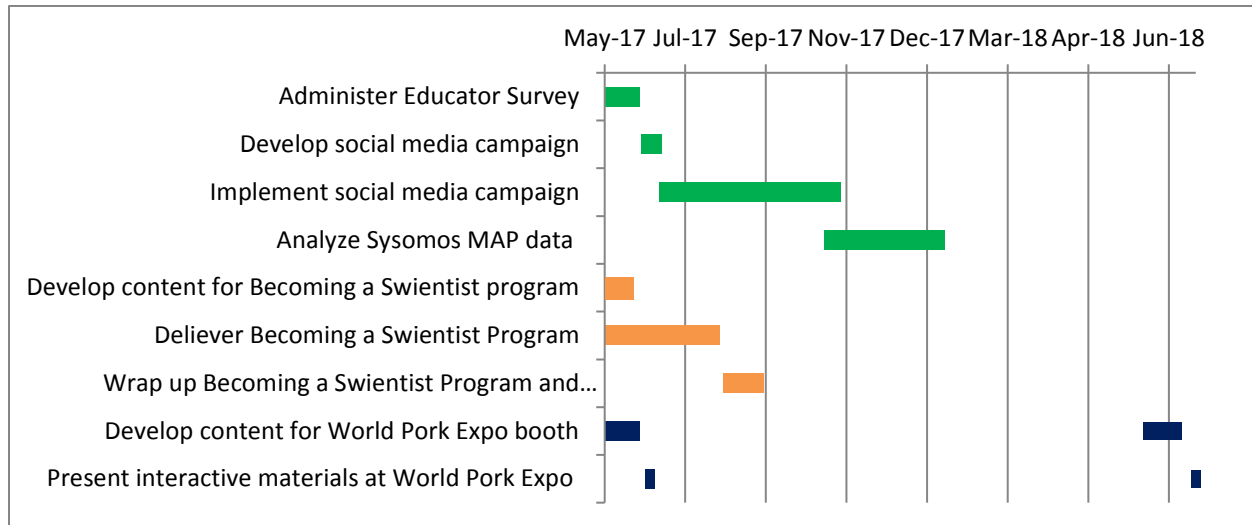
Descriptive analysis of the number of participants will be conducted, and the team will subjectively gauge their level of engagement to assess the efficacy of the program.

Objective 3: Expected Outcomes

Reaching this population of show pig enthusiasts can result in a trickle-down approach of knowledge dissemination because these breeders are selling pigs annually to youth for agricultural

education projects at the local level. These breeders are viewed by the youth and their families as the local experts on swine care and management and are the ‘go to’ resource for the youth.

Timeline:



Human subject review process:

Research protocols will be reviewed and approved by Institutional Review Boards (IRB) at The Ohio State University in order to protect the rights and welfare of human research subjects. The proposed project will involve minors and thus, will be subject to additional protective safeguards to protect this population of vulnerable human subjects. If required by IRB, human subjects volunteer will participate in research only after providing legally effective informed consent. The team of investigators will not solicit subject participation or begin data collection until they have received approval from the appropriate IRB or written concurrence that the research has been determined to be exempt from IRB review.

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