**Thesis Project Portfolio**

# Improving the Skin Prick Allergy Test: Exploring the Effect of Operator-Dependent Factors on Test Variability

(Technical Report)

# The Ongoing Impact of Allergies: Evaluating Allergy Testing Accessibility in Healthcare

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2025

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## Executive Summary

A test that can't be trusted—and can't be accessed—is a test that fails twice. My work seeks to improve both the accuracy and accessibility of allergy testing. The goal of my capstone project is to standardize the skin prick allergy test, which is highly influenced by operator-dependent factors like force and angle of application. Through the work of my capstone project, my group and I will determine which operator-dependent factor is causing the most variation in results, and then design a new test method and/or accessory for allergy testing in order to increase its accuracy and reliability. My STS research focuses on the creation of allergy testing in terms of accessibility and whether or not it was designed, tested, and delivered to the public in an accessible manner. This is important because creators of such technology, like engineers for example, are responsible for not only their physical product, but also the impact of their technology in society, including its accessibility, which is an argument supported by the Responsible Research and Innovation (RRI) framework. Thus, in conducting this research, I can better design a new method and/or accessory for my capstone project that not only improves the accuracy and results of the test, but also addresses accessibility concerns that the current designs overlook.

The skin prick allergy test produces a false positive result 50% of the time. This is due to a variety of factors, including the way the test is administered and interpreted. Getting a misdiagnosis can lead to a series of unnecessary lifestyle changes and treatments, which is why it is so important to improve the test. For my capstone project, my team and I tested three different skin prick devices that currently exist to see which one caused the least variation in results. Once this test was conducted, we took the device with the least variation and tested it for variability in

terms of force and angle. Using this data, we developed some solutions that addressed the most influential operator-dependent factor.

The results show that the least variable device was the Duotip device, a plastic prick with a two-pronged tip, with a coefficient of variation (CV) of 0.32 as compared to its counterparts with CVs of 0.60 and 0.78. The results also show that there was no significant difference between the different force conditions nor the different angle conditions when testing with the Duotip device, suggesting that the factor contributing to the majority of variability has not been identified through these series of tests, and more research is required in this area.

My STS research explores how the evolution of allergy testing has addressed—or failed to address—issues of accessibility and inclusivity. Despite advancements in allergy diagnostics, significant disparities remain, particularly affecting underserved populations due to factors like race, socioeconomic status, and geographic location. The significance lies in the need for equitable access to reliable allergy testing, which is crucial for both individual and public health. I analyze the three major stages of medical device development—design, testing, and distribution—through the lens of the RRI framework, emphasizing the moral responsibility of engineers and healthcare professionals to create socially inclusive technologies.

The RRI framework offers a strong path toward making allergy testing more accessible, inclusive, and culturally sensitive. By encouraging diverse participation, community engagement, and better healthcare training, RRI can help make sure these technologies serve all populations—especially those historically underserved. Future steps would be to apply RRI principles in real-world studies to see if they truly improve the accessibility, affordability, and effectiveness of allergy testing.