# CALIFORNIA SCIENCE & ENGINEERING FAIR
## 2019 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**S0322**

**Project Title**

# Reducing the Incidence of Falls among the Elderly

**Abstract**

**Objectives**

Problem: According to the CDC, over one in four adults age 65 and over fall in a given year. Despite increased recognition regarding the negative consequences of falls and increased implementation of fall-prevention awareness and exercise programs, the rate of falls has been on an upward trend almost every year since 2002. The rate of falls in 2016 (the most recent year available) was the highest since at least 2001. Falls can result in everything from a bruised ego, to broken bones, to even death. Unintentional falls are the leading cause of accidental death for people age 65 and over.

Hypothesis: The incidence of falls among people age 65 and over can be reduced with the use of a specially designed shoe with a wider sole than a standard shoe. The wider sole will create a larger base of support and lower Center of Gravity, providing more stability and improved balance.

**Methods**

Procedure: This research study included three primary components: 1) a survey of elderly people regarding their experiences with falls, 2) design and construction of a life-size mannequin for testing, and 3) design and testing of fall-prevention shoes.

The fall survey asked questions covering topics ranging from the number of times fallen in the past 12 months, the nature of the falls, and the location of the falls; as well as their attitude towards potentially wearing fall-prevention shoes. 41 people were surveyed.

Initially, an attempt was made to construct a life-like mannequin with bendable ankles, knees and hips. However, the mannequin was unstable, and so a second more rigid mannequin was constructed and utilized for testing.

The test shoes included three different sole sizes: a standard women's sneaker (the most common shoe type worn when a fall occurred), and two pairs of fall-prevention shoes with a sole-widening strip of rubber adhered to the perimeter of the rim of the sole (1 cm and 2 cm widths).

Three tests to determine the effectiveness of the shoes included: 1) a Tilt test, 2) a Wobble (or oscillation) test, and 3) a Drop test. The tests included setting the mannequin in motion either forward, sideways, or backwards, and measuring the angle at which it either fell over or the extent of movement, or in the case of the Drop test, whether the mannequin remained standing or fell.

In addition, a physical therapist and two primary care physicians were interviewed for insights on elderly falls and thoughts about a fall-prevention shoe.

**Summary Statement**

Specially designed shoes with wider soles than standard shoes create a larger base of support and improve balance and stability which could reduce the incidence of falls among the elderly.

**Help Received**

My advisor, Mrs. Lopatka, provided project guidance; while Mrs. Rafie, a physics teacher at my school provided insights about balance. Regarding shoe design and effectiveness, I talked with a physical therapist and two physicians. My father helped me throughout the project.