

**3D LUNG VOLUME CALCULATION FOR SCOLIOSIS**

**BARRIERS TO HEALTHCARE FOR THE MARSHALLESE IN NORTHWEST  
ARKANSAS**

An Undergraduate Thesis Portfolio  
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Bachelor of Science in Biomedical Engineering

By

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with Tony Albini and Will Farley

Technical advisor: Dr. Keith Bachmann, Department of Orthopedic Surgery

#### **BARRIERS TO HEALTHCARE FOR THE MARSHALLESE IN NORTHWEST ARKANSAS**

STS advisor: Catherine D. Baritaud, Department of Engineering and Society

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## **SOCIOTECHNICAL SYNTHESIS**

Some groups have fallen between the cracks in the US health care system. Often these groups face unique barriers to treatment, and the standard of care and health care infrastructure are not created with these groups in mind. The technical portion of this was undertaken to provide better care to an underserved patient population in healthcare. The STS research project also focuses providing better care to an underserved patient population. The STS research project analyzes the barriers to care that this population faces using Actor Network Theory and proposes a solution.

Spinal fusion surgery is a common procedure to correct early onset scoliosis. In order to determine if spinal fusion surgery should be performed, accurate measurements of the patient's total lung capacity are needed. If spinal fusion surgery is performed before the lungs have sufficiently developed, then patients can develop restrictive pulmonary disease. Two common methods for measuring total lung capacity are spirometry or pulmonary function testing, and computed tomography. Both of these current methods have drawbacks that are more prominent with early onset scoliosis patients.

X-ray images are already taken to monitor the progression of early onset scoliosis. Therefore, if these images are used the patient would not be subjected to additional costs or radiation. Using X-ray images will provide a novel method for calculating total lung capacity and allow physicians to better serve young children and those experiencing disability. Total lung capacity was calculated using a neural network to model chest volume and predicting mediastinum volume from patient demographics. The mediastinum volume was able to be predicted with a mean absolute percentage error of 15% and the chest volume model still needs further optimization.

The Marshallese community in Northwest Arkansas has been disproportionately affected by tuberculosis and more recently Covid-19. The STS research project investigates why the Marshallese in Northwest Arkansas have been disproportionately affected by outbreaks. The paper identifies multiple barriers to healthcare access for the Marshallese, but a lack of health insurance is identified as a prominent barrier that is addressed with a solution. The paper uses Actor Network Theory and peer reviewed, scientific publications to further explore these barriers and a solution to a lack of healthcare coverage in the form of Medicaid sign up events hosted at local Marshallese churches.

When the Marshallese first came to the United States, they were eligible for Medicaid. However, from 1996 to December of 2020 the Marshallese their eligibility was rescinded and in 2017 46% of the Marshallese had no form of healthcare coverage. Due to the withdrawal of Medicaid services and the United States' historical exploitation of the Republic of the Marshall Islands some of the Marshallese in Northwest Arkansas do not trust the government and the United States healthcare system. Previous public health outreach programs have found that cultural sensitivity and community partnership lead to greater community interest and acceptance of the program. Greater community acceptance and interest paired with historical distrust of the United States healthcare system led to the inclusion of Marshallese community groups and churches in the proposed Medicaid enrollment events.

Both the technical and STS research project aim to provide better healthcare to underserved populations. Each found that it is important to look into the barriers to care that a community faces and implement a solution that works with the community and is tailored to their needs.