

Thesis Project Portfolio

**Computational Flow Dynamics Analysis of Pelvic and Abdominal Veins Using CT,
Venography, and Duplex Imaging**
(Technical Report)

A Sociotechnical Analysis of College Alcoholism
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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The connection between the proposed technical project and research paper is loose, considering the technical project was not personally chosen, however, the two do relate to one another in various ways. In comparing computational flow dynamics (CFD) analysis of patient veins with deep vein thrombosis (DVT) to an analysis of the contributing factors on the influence of college alcoholism, a relationship can be drawn through alcohol. A common cause or contributing factor to an increased risk for DVT formation is consuming excessive amounts of alcohol, which is known to increase the number of platelets present within the blood, increasing the likelihood of random clotting (Admin c, 2019). In the CFD analysis of vein models, the number of platelets in the affected area of the vein can be related to the flow velocity and flow patterns seen in the blood. Therefore, the research paper gives insight into the type of students' clinicians may need to pay special attention to if there is a need for medical treatment due to blood clot formation in the body.

The technical project of this thesis involved an analysis of lower extremity deep vein thrombosis (DVT), which is a very common but potentially fatal condition where blood clots in a deep vein causing partial or complete blockages as well as blood flow irregularities within the vein. Patients who suffer a DVT may experience intense leg pain and swelling, but many patients are asymptomatic. In the process of diagnosing patients with DVT, various imaging modalities are utilized such as computerized tomography (CT) scans, venography and ultrasound in order to confirm the presence of DVT. The current treatment for patients with DVT is a procedure involving angioplasty stent placement to rid of the venous occlusion and improve blood flow. However, the exact mechanism for formation of venous stent stenosis is still unclear. In many patients who received stenting treatments develop stenosis, even after the occlusion was originally

cleared out. One of the project advisors noticed in CT and venography scans that there was a higher tendency for the thrombus to occur on the lesser curve side as opposed to the greater curve side. The goal of this technical project is to analyze data from CT, duplex ultrasound, venography, intravascular ultrasound and pressure measurements from patients with DVT to develop a CFD model of the lower extremity venous anatomy and to understand the contribution of flow rates and patterns on the formation of DVT. In order to accomplish this goal, we will be reconstructing CT data of the iliac vein with volume rendering to create a 3D model. This model will then be used to run simulations of blood flow. To run these simulations, we must identify the appropriate and most significant parameters to consider. We will then verify our model with clinical data as well as analyze blood flow in patients with DVT and healthy patients. Modeling individual patient anatomy of patients will potentially allow us to determine why stent stenosis occurs more frequently in the lesser curve of the iliac vein.

Excessive alcohol intake is a common practice in many U.S. colleges, which provides purpose for an analysis of the various contributing factors and their influence on the presence of college alcoholism and binge drinking in the U.S. The contributing factors that have the highest impact on colleges students, typically between the ages of 18 and 22, are their environmental and personal factors. The analysis being performed would be helpful to understand how college students' immediate situation and surroundings influence the presence of college alcoholism and binge drinking. This begs the following research question: How do various environmental and personal factors influence the presence of college alcoholism and binge drinking in the U.S.? In order to answer the proposed research question, utilization of Social Construction of Technology (SCOT), with alcohol representing the technology, is helpful in mapping the various stakeholders involved in understanding the influence of environmental and personal factors on alcohol abuse,

such as the students' themselves, their friends, professors, families, the school, medical professionals, law enforcement and many more. With a better understanding of the influence of these environmental and personal factors, it is plausible to use the information obtained to develop more effective intervention and prevention programs in U.S. colleges. Through this research, one would expect to develop a better understanding of the ways in which various personal and environmental factors contribute to a child's likelihood for developing an alcohol dependence, which would allow for more attention being devoted to students who need it.

In performing both projects simultaneously, there is great benefit in being able to use information learned from one of the projects to then apply to the other project, or vice versa. The information gained from performing the STS research analysis was beneficial to the technical project because the mechanism for thrombus formation in stents is really unknown, so a better understanding of which patients may be more likely to have irregular blood flow due to excessive alcohol intake, would lead to an additional treatment group to potentially perform CFD analysis on to create more effective treatment protocols. In addition, the analysis learned from the technical report could serve as ample scientific data to use in the development of treatment and prevention programs on college campuses. Given that alcohol is a contributing factor to the formation of blood clots, the data could be presented as a deterrent for college students. The two projects, although rather loosely connected in their content, there is a large benefit to conducting these two projects at the same time.

References.

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