ANALYZING THE DIFFERENCE IN THE PERCEPTION OF OVER-THE-COUNTER DRUGS AND ANESTHESIA DRUGS USING ACTOR NETWORK THEORY

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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DEVELOPMENT OF AN ADAPTOR FOR THE NASAL CANNULA AND A COMPARISON OF THE PERCEPTION OF OVER-THE-COUNTER DRUGS AND ANESTHESIA DRUGS USING ACTOR NETWORK THEORY

Medical avoidance is a phenomenon where a person willingly delays or completely avoids obtaining health care at the cost of their own well-being. Medical avoidance can lead to a simple issue becoming worse if the person ignores it for too long, making it more difficult or expensive to fix later on as more advanced procedures are required. According to a report from the Center for Studying Health System Change's (HSC) nationally representative 2007 Health Tracking Household Survey, in 2003 one in seven (13%) Americans reported not getting or delaying needed medical care and by 2007 this had increased to one in five (20%) Americans (Cunningham & Felland, 2008). This percentage has grown in recent years, with the recent Covid-19 pandemic highlighting this issue even more. The reasons a person may practice medical avoidance are slightly different person to person, so the reasons being looked at for the technical and STS paper are cost and fear respectively. Finding ways to reduce either of these barriers would make people more likely to get the medical attention that they need as soon as possible; however, there are many factors that affect these reasons, so it will be impossible to find one specific cause of these issues.

The technical project and tightly coupled STS research project proposed in this prospectus directly address the issue of medical avoidance from different perspectives. The technical project will focus on the physical aspects of medical avoidance and will be recorded in a technical report, while the STS project will focus on the mental aspects of the medical avoidance and will be recorded in a scholarly article. The goal of the technical project is to create an adaptor for the dual nasal cannula that will allow it to be placed in the mouth instead of

the nose during facial plastic surgery. Placing the cannula into the mouth will stop it from obstructing the facial plastic surgical field, and will make surgeries cheaper and faster by allowing surgeons to utilize monitored anesthetic care (MAC) instead of general anesthetics. MAC allows for the patient to be partially sedated, making them unaware of their surroundings, while still breathing on their own. This prevents surgeons from having to perform an endotracheal intubation, or placement of a breathing tube, to complete the surgery (Bitar et al., 2003; Taub et al., 2010). Using MAC is cheaper and faster than general anesthesia, and also avoids the risks associated with general anesthesia and endotracheal intubation such as injury to teeth, lips and gums, bleeding, and aspiration of gastric contents leading to pneumonia (Bitar et al., 2003; Jaisani et al., 2015; Taub et al., 2010). Tightly coupled, the STS research will attempt to identify factors that can lower the level of fear in the public's perception of anesthesia by looking at the differences in the current perception of over-the-counter drug usage and anesthetic drugs in surgery, revealing where the perceptions of these technologies originate. These differences will be compared by the creation of two Actor Network Theory models, in accordance to the Actor Network Theory (ANT) (Cresswell et al., 2010). The models will compare what is similar and different between the two networks, and how the interactions between the networks are formed and modified, and help with the creation of suggestions for reducing medical avoidance.

Lowering the chance a person will practice medical avoidance will lead a healthier overall population, and by making surgeries more appealing to patients the likelihood that someone will go to receive the medical care they need is increase. Solutions to medical avoidance can focus on the issue physically or mentally. By making an adaptor for the nasal cannula, facial plastic surgeries become easier for surgeons to perform, and increase the number

of surgeries that can be performed under MAC instead of general anesthesia. Removing the need for general anesthesia not only lowers the cost and risks for the patient, but may also lower any anxieties that may arise from surgeons not using medical devices as they were intended. By looking at the perception of anesthesia compared to over-the-counter drugs, the factors that cause the differences in how society views them may provide avenues to help improve the view of anesthesia. With the technical report looking at developing physical methods to reduce medical avoidance, and the STS scholarly article looking at the mental factors that cause medical avoidance, the overall goal of these projects is to find ways to get people to be more willing to undergo surgeries, leading to a healthier society. An application of the findings described in the STS paper below is beyond the scope of this paper; however, identifying the major factors that dictate how the population reacts to anesthesia drugs is necessary to develop solutions that aim to eliminate the practice of medical avoidance. This research paper will be organized by describing medical avoidance in the population over the last few years and explaining the current perception on anesthesia drugs and over-the-counter drugs, defining and explaining the two models being used to evaluate these technologies (the Technology and Social Relation model and the Actor Network Theory model), applying these models to the technologies, and finally explaining what the models highlight about the technologies.

THE CURRENT PUBLIC PERCEPTION ON THE MEDICAL SECTOR

INTRODUCTION TO THE PRACTICE OF MEDICAL AVOIDANCE

Major medical procedures are events that can affect someone for the rest of their lives. Not only can the surgery itself be long and take hours, but the recovery time can last for days or

weeks, and the quality of life of the patient will change for the better or worse afterwards. This makes surgery procedures a big decision to make, which can cause anxiety in patients. During the recent COVID-19 pandemic, Mark É. Czeisler found that about 41% of the population had reported to having delayed or avoided any medical care, with 12% avoiding emergency care and 32% avoiding routine care, and the primary reasoning being concerns about COVID-19 (Czeisler, 2020). While a pandemic can be seen as an extenuating circumstance, there are still other factors that can affect the anxiety of getting medical care. In a study done by Kyle T. Smith a few years before the COVID-19 pandemic, he found that 45% of the participants would delay or avoid medical care due to factors like cost, even though many of them were insured (Smith et al., 2018). Figure 1 is a graph that shows how the percent of Americans that practice medical avoidance has increased over the years.

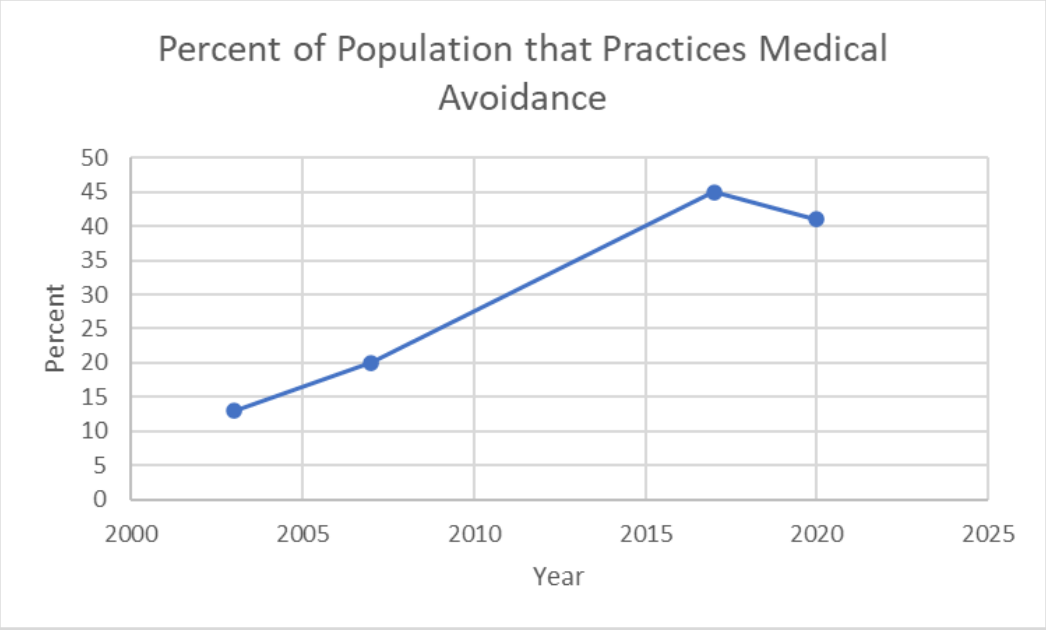

Figure 1: This graph shows how medical avoidance has increased in Americans. (Adapted by Michael Epps (2023) from Cunningham & Felland, 2008; Czeisler, 2020; and Smith et al., 2018)

Medical avoidance as a practice can be seen more clearly when comparing marginalized populations to the majority populations. Black and Latino communities were more likely to test positive and suffered a higher mortality rate during the recent COVID-19 pandemic (Misa et al., 2021); however, these communities were found to be more likely to avoid seeking both routine and emergency care and more reluctant to engage in COVID-19 specific care (Carethers et al., 2020; Czeisler, 2020). The rates of medical avoidance being different depending on the community leads to the idea that medical avoidance is a learned practice, and that there are underlying factors that cause these communities to act this way. Lowering medical avoidance can be done by determining what these underlying factors are and developing ways to combat them.

Medical Avoidance in Surgeries Caused by Anesthesia Drugs

The STS research paper sets out to analyze the mental aspects of medical avoidance, and with anesthesia drugs in particular, the largest mental factor that can dissuade a patient is fear. The fear of the anesthesia can sometimes be greater than the fear of the actual surgery itself. In a study done by ME Ruhaiyem, it was found that the top three causes of patient fears were the fear of postoperative pain, intraoperative awareness, and being sleepy postoperatively, representing about 77%, 74% and 70% respectively (Ruhaiyem et al., 2016). Patients were found to be less fearful of factors like needles in the operation, revealing personal issues under general anesthesia, and of not waking up after surgery, with those coming in at 48%, 55%, and 56% respectively (Ruhaiyem et al., 2016). The fear of dying from the anesthesia is tied to the severity of the surgery, with the fear of death increasing as the severity increased (Burkle et al., 2014).

It is important to be aware that the fear of anesthesia is affected more by age than education level, with patients aged 40 and up expressing more fear of anesthesia than younger

patients (Ruhaiyem et al., 2016). Ruhaiyem concludes that this discrepancy is mostly likely because younger people are more trusting of modern medicine, and because older people are more likely to have had a bad experience with anesthesia before. Thus, it could be true that the issue of medical avoidance will solve itself as modern medicine continues to improve and that there is no need to be concerned with the level of medical avoidance being showcased in the current population. This line of thinking however, may not be true with the perception of anesthesia drugs. There is historical precedent to believe that the advancement of modern medicine may not be enough to alleviate these fears.

Looking at the history of anesthesia, there has been a significant decrease in accidents, which was shown when Dr Daniel Bainbridge compiled studies of more than 21.4 million anesthetic administrations given to patients undergoing general anesthesia for surgery over the last few decades. From those studies, the morality rate solely attributable to anesthetics fell from 357 per million before the 1970s, to 52 per million in the 1970s and 80s, to 34 per million in the 1990s and 2000s. Total perioperative mortality decreased over time, from 10,603 per million before the 1970s, to 4,533 per million in the 1970s–80s, and 1176 per million in the 1990s–2000s (Bainbridge et al., 2012). In spite of these large statistical improvements, there is still a fear of anesthesia, and an increasing practice of medical avoidance. While the younger population does express less fear than the older population, the degree of improvement anesthesia can have in the future in relation to patient safety is smaller than what has already been accomplished, small enough that one would argue the level of fear will not go down in future generations. Understanding why there is still a fear of anesthesia despite these improvements can help develop methods to increase the amount of people who go get the medical care they need.

Over-the-counter Drug Use in Society Encourages Medical Avoidance

While the idea of anesthesia being used for surgeries can cause anxiety and fear, the general perception of over-the-counter drugs in society is completely different. Reports have shown that 93% of adults in the U.S. have been found to treat illnesses with over-the-counter drugs before seeking professional medical help, and 85% of parents prefer to treat illnesses in their children with over-the-counter drugs before seeking professional medical help (*Over the Counter (OTC) Drugs Market Size, Report 2022-2030,* n.d.). In a study done by C. Mel Wilcox, it was found that 54% of users were not aware of the potential side effects of these drugs, and that 18% of users had previously experienced side effects but still continued to use them (Wilcox et al., n.d.). Users of these drugs use them without worrying about the consequences that may come, and continue to use them even if they know or have experienced these consequences.

There are many possible factors that could lead to this, such as cost, speed, convenience (Blenkinsopp & Bradley, 1996). Over-the-counter drugs are named as such because they can be acquired easily from a pharmacy or convenience store. While a doctor can prescribe a patient a specific drug to get, over-the-counter drugs don't require a doctor's permission and do the exact same thing as many prescription drugs. Over-the-counter drugs and anesthesia drugs are both affected by similar outside factors, which is why a comparison between the two categories is possible. Understanding why the perception in prescription and over-the-counter drugs is so different from anesthesia could help find ways to reduce the anxieties that anesthesia brings and lessen the amount of people who would prefer using over-the-counter drugs to getting proper medical help.

COMPARING ANESTHESIA DRUGS TO OVER-THE-COUNTER DRUGS USING THE ACTOR NETWORK THEORY MODEL

INTRODUCTION TO THE ACTOR NETWORK THEORY MODEL

In order to make a comparison on the perception of over-the-counter drugs and the perception of anesthesia in surgery to find factors that may cause medical care avoidance, a model of the two technologies need to be made. The best model to showcase these differences and similarities is the Actor Network Theory model, which is based off of the Actor Network Theory (ANT) framework, originally developed in the early 1980s by Michel Callon, Bruno Latour and John Law (Cresswell et al., 2010). Cresswell writes that the ANT framework "attempts to 'open the black box' of science and technology by tracing the complex relationships that exist between governments, technologies, knowledge, texts, money and people. It are these connections that result in science and technology, and by examining them it becomes easier to describe why and how we have the science and technology that we do" (Cresswell et al., 2010, p. 3). Written another way, ANT is a way of viewing technology in a network that is made up of human and non-human actants, and by finding the differences in the actants, an understand on how the social view surrounding technology came to be can be found. An example of what this model may look like is seen below in Figure 2. Over-the-counter drugs and anesthesia have a lot of the same actants in their networks, which is how a comparison between the networks will be achieved. Since networks are built by their actant connections, analyzing these connections can determine which actants, if altered, would lead to changes that affect the network in a specific way. A network connection between actants is not always a positive relationship, which means that altering the way one actant is interacting can negatively or positively affect the entire network web.

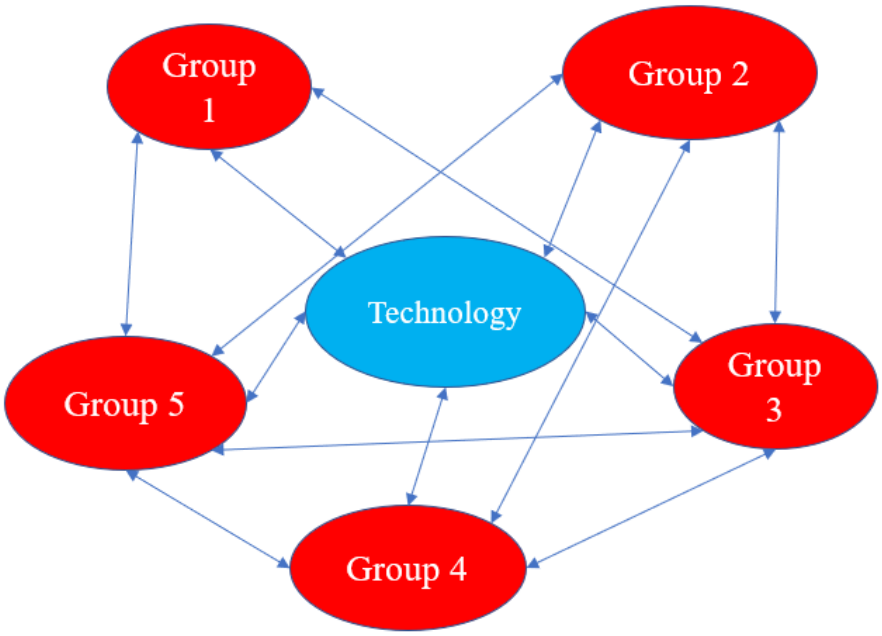

Figure 2: ANT Model. This figure shows various groups (red) that affects a technology (blue) and how they are connected (Adapted by Michael Epps (2023) from Cresswell, 2010).

Building the Actor Network Theory Model Off of the Technology and Social Relation Model

The ANT framework has a lot of interconnecting parts, as such, it will be very important to ensure that each actant is correctly defined in how they interact. This will be accomplished by first using the Technology and Social Relations STS framework (Carlson, 2009), which can be seen below in Figure 3. This framework looks at how different groups that interact with the user of the technology can be positively or negatively affected, with the technology being either over-the-counter drugs or anesthesia during surgery. The Technology and Social Relations STS framework is similar to ANT, but there are no connections between the groups themselves, the relevant actants are only tied to the user. The factors that cause the differences in the perception

of similar technologies can be found by looking at how the relationship with each group connected to the technology is changed when using it. Starting the analysis from a simpler STS framework will make it easier to understand each group and will make the differences in the connections between groups easier to see when using to the more complex ANT framework.

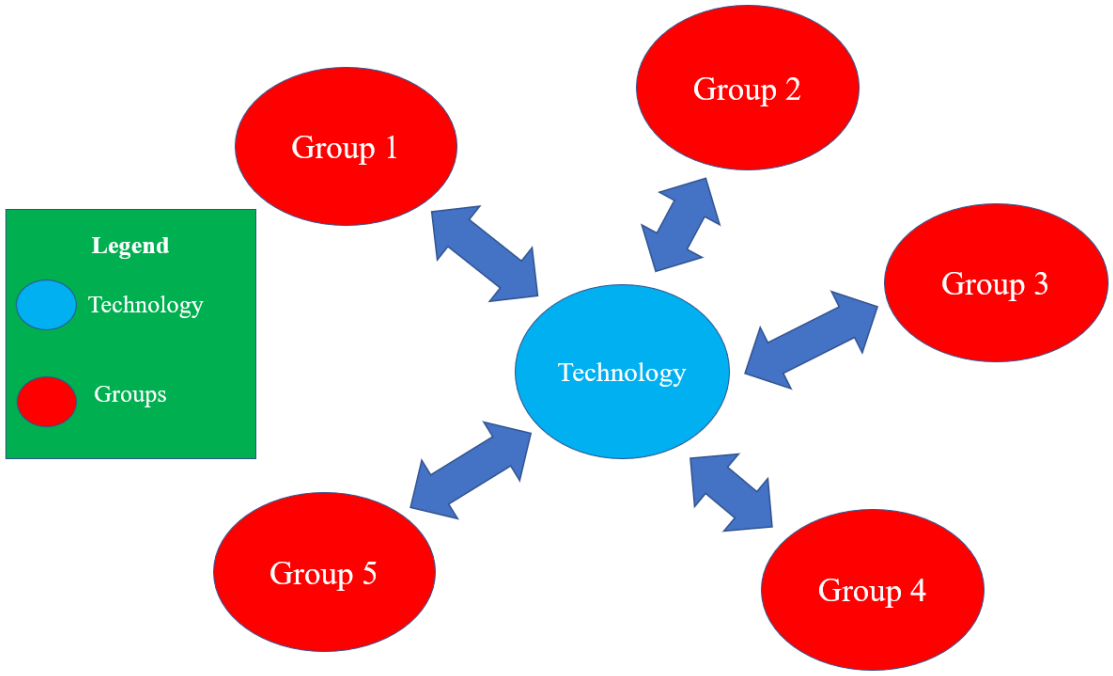

Figure 3: Technology and Social Relation Model. This figure shows how the network will be organized to not have any connections between groups in order to correctly define how each group behaves (Adapted by Michael Epps (2023) from Carlson, 2009)

Defining the Actants to Build the Technology and Social Relation Model

There will be three main actants that the model will consider: The government, doctors, and daily life. These three actants were chosen because they have the most affect over the technologies being compared and because they affect each of the technologies. It should be noted that pharmacies play a major role in over-the-counter drugs, but as they don't have any affect over anesthesia drugs, they were not included as an actant. Expanding the number of

actants in a future study will lead to a more complex model but will also lead to a more in-depth solution.

The first actant to be looked at will be the government. While government regulation is an actant in both technologies, the form it takes is very different. For anesthesia drugs during surgery, government regulations require the anesthesia drugs to only be administered by an anesthesiologist. An anesthesiologist is a doctor who specializes in sensation and pain management (*What Does A Career In Anesthesiology Look Like?*, 2020). They typically administer and monitor local, regional, or general anesthesia or sedation before, during, or after medical procedures and surgeries. The requirements to become an anesthesiologist are agreed upon by the government and current doctors, which includes completion of a four-year bachelors' degree, a four-year medical degree, and four years of residency, passing the national Board exam, completion of a fellowship program or spending two years in private practice, gaining certification, and taking a licensing exam (*Home | United States Medical Licensing Examination*, n.d.; *What Does A Career In Anesthesiology Look Like?*, 2020). Once that is done, all physicians must regularly complete continuing education courses to maintain and update their specialized certifications. These restrictions only affect who can become an anesthesiologist, but the actual drugs given during surgery are left up to the discretion of the anesthesiologist to decide. As such, the government doesn't have any control over anesthesia drugs in a surgery room.

Over-the-counter drugs are regulated by the Food and Drug Administration (FDA) and are defined by the FDA as "medication created to be the same as an already marketed brand-name drug in dosage form, safety, strength, route of administration, quality, performance characteristics, and intended use. These similarities help to demonstrate bioequivalence, which

means that a generic medicine works in the same way and provides the same clinical benefit as the brand-name medicine" (Research, 2021). The FDA conducts a lengthy review of each drug to ensure generic medicines meet the same standards as prescription drugs, as well as conducting inspections of manufacturing plants and monitoring drug safety after the generic medicine has been approved and brought to market. As such, each over-the-counter drugs has gone through multiple checks before it can be sold in stores, and has been deemed safe enough for the general public to handle by themselves. The full procedure for how the FDA approves over-the-counter drugs looking to be brought to the market can be found by looking at their drug application process (Research, 2019, 2021, 2022).

The next actant to consider is the doctor. With anesthesia drugs, the doctor is someone who has done years of schooling and will be there before, during and after the surgery. The anesthesiologist is supposed to pick the drugs that will keep the patient as safe as possible while limiting the pain and discomfort they feel from the procedure. Picking between general anesthesia or MAC may be a choice that is decided by the surgery type, or the anesthesiologist depending on how the patient would react to certain drugs. Being an anesthesiologist means their entire job is to deal with anesthesia drugs, as such, they have full control over the drug that is administered to the patient (*Get Certified*, n.d.; *Home | United States Medical Licensing Examination*, n.d.; *What Does A Career In Anesthesiology Look Like?*, 2020). With over-the-counter drugs, there is no doctor directly. The is different from pharmacies, which were not included because they don't play a role in anesthesia drugs and are not required for the sale of over-the-counter drugs. The lack of doctor inclusion in over-the-counter drugs is a necessary condition that makes them over-the-counter, which makes the lack of connection an important factor to consider and will be indicated in the model.

The final actant to be considered is daily life. This actant is more complex than the first two as it will change depending on the person and the situation, but it is still a major factor in how both technologies are perceived. Anesthesia will require a patient to avoid doing things before and after the procedure. A patient may be forced to stop taking certain medicines and may not be allowed to eat or drink for a specific period of time. After a procedure, a patient must stay at the hospital to be watched in case of side effects, and may not be able to return to work for a few days depending on the type of job or procedure done. These are all things that disrupt the daily life of a person, and may require the patient to get outside help, like having someone drive them home from the hospital (*General Anesthesia - Mayo Clinic*, n.d.). For over-the-counter drugs, the effect on daily life is very miniscule. They can be picked up whenever the person has free time, they don't require the person to change their routine before or after using them, and they can be used without any outside help.

These actants are then connected to the technology based on the above explanations in order to create the two Technology and Social Relation models. As seen below in Figure 4, anesthesia has two positive connections with the government and the doctor and one negative connection with daily life.

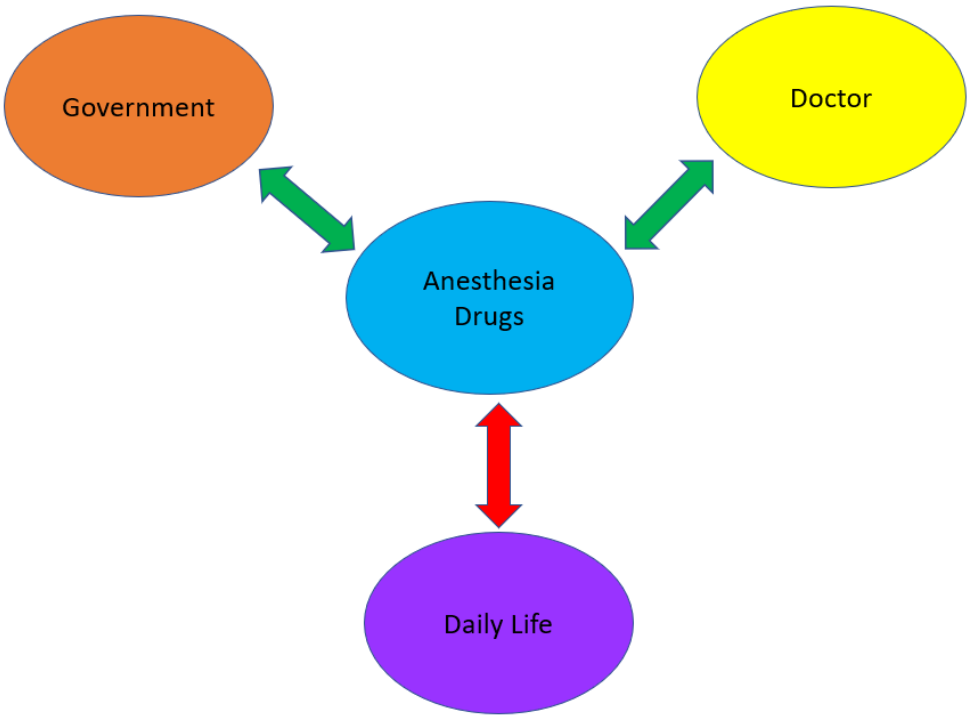

Figure 4: The Technology and Social Relation Model being applied to Anesthesia Drugs. The green arrows indicate a positive relationship, the red arrow indicates a negative one (Adapted by Michael Epps (2023) from Carlson, 2009)

Over-the-counter drugs have two positive connections with the government and daily life and one non connection with the doctor; however, as the lack of connection between over-the-counter drugs and doctors is necessary for the definition of over-the-counter drugs, this connection can be interpreted positive, meaning there is functionally three positive connections for this technology, which can be seen in Figure 5 below.

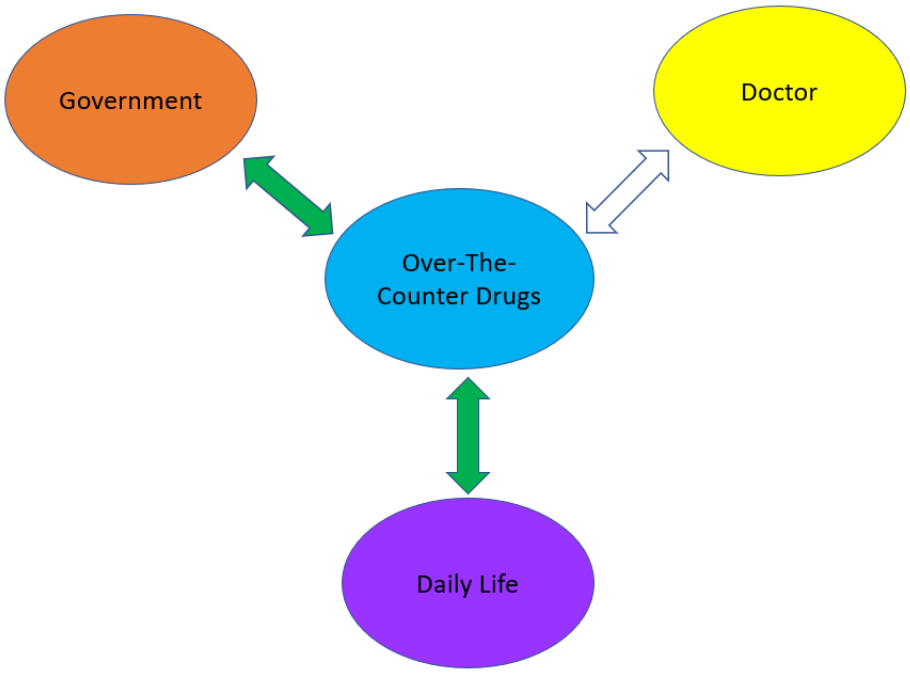

Figure 5: The Technology and Social Relation Model being applied to Over-the-Counter Drugs. The green arrows indicate a positive relationship, the blank arrow indicates no relationship (Adapted by Michael Epps (2023) from Carlson, 2009)

Defining the Connections between Actants to Create the Actor Network Theory Model

In order to convert this model from a Technology and Social Relation model into an ANT model, these three actants must also connect to each other and the negative or positive connections between the actants will be analyzed in how they affect the technologies. For anesthesia drugs, the government and doctors have a positive relationship, as the strict requirements in place that a doctor must meet in order to become an anesthesiologist are agreed upon between the government and organizations of doctors like the Federation of State Medical Boards and the American Board of Anesthesiology (*Get Certified*, n.d.; *What Does A Career In Anesthesiology Look Like?*, 2020). The doctor and daily life have a negative relationship

because the doctor will require a patient to alter their routine for the anesthesia (*General Anesthesia - Mayo Clinic*, n.d.). The government and daily life have no relationship, because the government lets the doctor handle all of the anesthesia procedures and restrictions on the patient (*General Anesthesia - Mayo Clinic*, n.d.; *What Does A Career In Anesthesiology Look Like?*, 2020). With these new connections added to the network, the ANT model for anesthesia drugs can be seen in Figure 6.

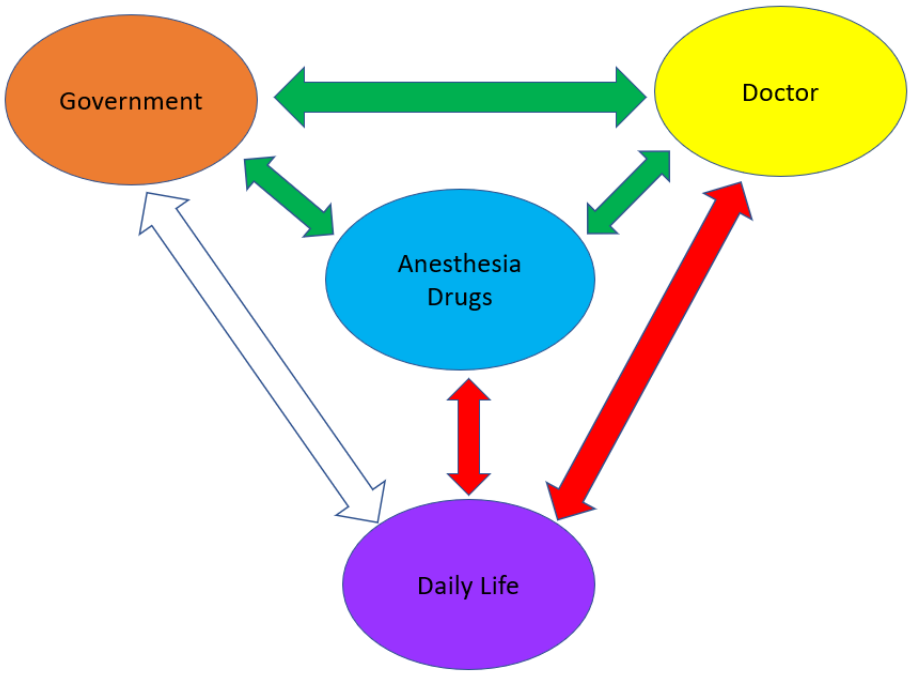

Figure 6: The ANT Model for anesthesia drugs. (Adapted by Michael Epps (2023) from Cresswell, 2010).

For over-the-counter drugs, the government and the doctors have a positive relationship, as the FDA acts as a stand in for the doctor in ensuring the safety of the drugs and prioritizes the wellbeing of the public (Research, 2021). The doctors and daily life have no relationship because there is no doctor to interact with a patient's daily life. However, the lack of doctors

means the user does not have to alter their routine in any way, which makes this connection functionally a positive one in the context of comparing to anesthesia drugs. Finally, the government and daily life have a positive relationship, as the FDA creates regulations that require over-the-counter drugs to be as easy to use and unrestrictive as possible for the general public (Research, 2021). The ANT model for over-the-counter drugs can be seen in Figure 7.

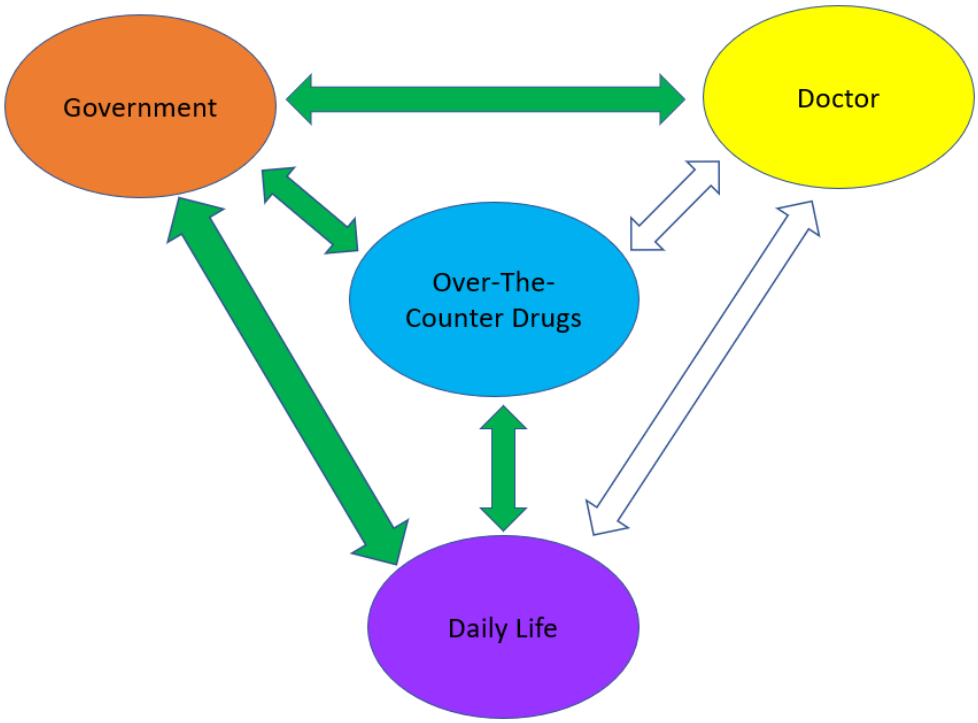

Figure 7: The ANT Model for over-the-counter drugs.
(Adapted by Michael Epps (2022) from Cresswell, 2010).

INTERPRETATION AND FUTURE IMPLICATIONS FOR MEDICAL AVOIDANCE SOLUTIONS FROM THE ANT MODELS

By comparing the models, it can be seen that the biggest factor between anesthesia and over-the-counter drugs is their affect on daily life. For anesthesia, daily life has two negative relationships and one non-relationship, while for over-the-counter drugs, daily life has two positive relationships and one non-relationship, with the non-relationship being a positive relationship in the context of the comparison being made. Based on these findings, looking for ways to reduce the impact anesthesia drugs have on the daily life of a person would be the best way to improve the perception of the technology and lower the fear the general population has for anesthesia drugs. This analysis was completed with only three major actants for each of the technologies, even though there are many more that interact with them. As such, this is an incomplete view on the networks for both of these technologies. Future research should look to include more actants into the model in order to create a more complete picture of the networks, with actants such as availability and finances being two possible inclusions.

Lowering medical avoidance is important to improving the overall health of the nation and would help instill good practices if there happened to be another emergency like the COVID-19 pandemic. While there are physical factors that can cause a person to practice medical avoidance, there are mental factors as well and the first steps to creating solutions to combat these mental factors causing medical avoidance is to identify the areas that need to be looked at. This report serves as a stepping off point for a such solutions to be found, as tackling the problem of medical avoidance from both a physical and mental perspective will create the best chance at reducing medical avoidance overall in the general public.

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