Discrimination Towards Women in the Health Industry: The Testing Fallacies that Led to the Thalidomide Tragedy

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Jacob Matthew Wilkins

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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

Advisor

Benjamin Laugelli, Department of Engineering and Society

INTRODUCTION

The thalidomide tragedy was a medical disaster that occurred in the late 1950s and early 1960s, which resulted in thousands of babies being born with severe birth defects. Thalidomide was a medication that was prescribed to pregnant women to treat morning sickness and aid sleep. However, it was discovered that thalidomide had devastating side effects on the developing fetus. Thousands of babies were born with severe limb abnormalities, such as missing or shortened arms and legs, as well as other birth defects. The thalidomide tragedy was a wake-up call for the pharmaceutical industry and regulatory agencies regarding the need for rigorous testing and evaluation of new medications before they are released to the market.

Current experts agree that this disaster was due to insufficient knowledge on how enantiomers may affect certain molecules. In fact, this discovery led to significant changes in drug testing regulations in many countries, including the United States, where the 1962 Kefauver-Harris Amendments to the Federal Food, Drug, and Cosmetic Act were passed in response to the thalidomide disaster. However, the current understanding for the reasoning of this tragedy limits people from seeing that the issue may have in part occurred due to a bias in health care and clinical research. Without properly emphasizing the role that gender bias had on the development and testing of the product, people will remain unaware that most health care systems have been historically inherently biased against certain groups of people. By better understanding these historical biases, engineers should be able to understand that implementing proper techniques in testing may help to prevent future products from harming certain groups.

I will use actor-network theory (ANT) to argue that the developers and testers of the thalidomide product, rather than the product itself, were the dominant actors that ultimately caused the deformities and deaths of thousands of infants. ANT is a framework that identifies a

network builder and actors and analyzes how each actor may have affected the development, or lack thereof, of the network. Specifically, I will determine that the exclusion of women from research and the oversight in the medical process helped to produce the tragedy in the 1960s. I will begin by laying out the exact events and timeline of the drug development and effects, as well as explain ANT. I will then define all of the human and non-human actors that played a role in building the network of the drug. In the context of this network, I will show that the drug makers were instrumental in the failure of the network because they failed to include the appropriate groups in their testing process, which led to a failure to detect the enantiomer that causes birth defects in newborns. I will do this by analyzing interviews and case studies of thalidomide victims, as well as papers and articles outlining the causes and effects of the tragedy.

BACKGROUND

Thalidomide was first developed by the German pharmaceutical company Chemie Grünenthal in the late 1950s. It was initially marketed as a sedative and hypnotic medication and was widely used in Europe, Australia, and Canada for this purpose. In 1957, the drug was introduced to the market as a treatment for morning sickness in pregnant women, following reports of its effectiveness in reducing nausea and vomiting. The drug became extremely popular among pregnant women, and it was estimated that between 10,000 and 20,000 babies were born worldwide with thalidomide-related birth defects.

The thalidomide (S)-enantiomer is a type of drug known as a teratogen, which means it has the potential to cause birth defects. Meanwhile, the (R)-enantiomer is an effective sedative medication (ACS, 2014). Unfortunately, under biological conditions the enantiomers can interconvert, making it near impossible to isolate just one. The harmful drug can cross the

placenta and enter the developing fetus, where it can disrupt the normal process of limb and organ development.

One of the main effects of thalidomide on fetal development is the inhibition of angiogenesis, which is the process of developing blood vessels. This can lead to the formation of malformed or missing limbs, as well as other abnormalities in the heart, ears, eyes, and internal organs. The first reports of thalidomide-related birth defects emerged in Germany in 1961, and soon after, cases were reported in other countries. The drug was quickly withdrawn from the market in most countries, but many babies had already been born with severe birth defects.

LITERATURE REVIEW

There have been many studies conducted to outline the history of the drug in order to prevent similar mistakes from other scientists. Most of these analyses tend to focus on the story rather than the root causes of the birth defects. Following the discovery of the birth defects, a plethora of research was conducted to find the reason for the interaction between the drug and developing fetuses. However, there was little to no research done on the social implications and causes of the problem.

In *Thalidomide: the tragedy of birth defects and the effective treatment of disease,* James H. Kim details the history of the drug and how it was pulled from the market when it was found that the drug was the cause of the problem. He goes on to explain the theories for the thalidomide mechanisms that could have been the causes of the problem. It can be seen in this article that a lot of research was done to find what could have been causing the birth defects, including extensive animal testing and multiple experiments. This shows that scientists and researchers were perplexed by the problem and wanted to understand the causes in order to prevent future disasters. Kim concludes that this taught lessons to scientists around the world, such as the

importance of systematic testing prior to marketing, the fact that animal testing results may not be fully applicable to humans, and that testing on multiple species of animals is important when drug testing. Kim reaches the conclusion that testing multiple species is an effective strategy since experiments determined that the drug affected different species in different ways. By determining how a product varies by animal, scientists may be able to predict how the product may vary when consumed by a human. Kim also goes on to explain that thalidomide has still proven to be useful in treating patients with leprosy and myeloma, given that the patient is not pregnant.

In contrast, *Animals and Medicine: The Contribution of Animal Experiments to the Control of Disease, Chapter 18: History of Thalidomide* by Jack Botting takes a different approach in its analysis of thalidomide. This article points out the flaws of the original drug testing before the marketing of the drug, rather than explain how the problem was tried to be solved after the fact. Botting reveals that this drug was able to harm so many mothers due to their utter lack of cohesive testing. According to him, the conducted tests were not stringent enough, as it had never been tested in pregnant animals or humans. As supported by Botting's book, animal testing was done far too late and after the damage had already been done. The drug had apparently only been tested in animals and humans that were not pregnant, despite the drug being marketed towards pregnant women trying to cure their morning sickness. The tests had also never included placebo groups, and information on how long each person took the drug was not indicated. In fact, "Widukind Lenz, one of the doctors who investigated thalidomide in the aftermath of the tragedy, said: 'The papers published in 1956 … on animal experiments and … on clinical experiences with thalidomide have so little scientific value that in my opinion they should not have been accepted for print.'" Finally, Botting concludes that while this was a

horrible situation, it increased guidelines such that an event like this has not happened in the past 60 years. Animal safety testing has been improved and regulated with very strict rules in order to prevent this. It is difficult to determine whether a situation like this needed to happen in order to prevent future disasters that had the potential to be worse. It is also difficult to say that animal testing is an ideal form of drug testing to protect humans. However, it is certain that more thought needs to be placed into drug distribution, specifically when testing specific groups of people that are typically marginalized by society and healthcare, as drugs may affect people differently depending on many factors.

Both of these articles outline the tragedy and how it affected thousands of women and children. However, they are each an example of the different approaches that can be taken towards health care tragedies, specifically when they affect a specific group. Kim's article fails to address the original testing procedures and simply describes research done afterwards to identify the core scientific issue. He does conclude that certain steps must be taken in the future to increase the quality of drug testing, but does not seem to identify the specific failures in the testing system in the first place. On the other hand, Botting analyzes the drug testing strategies and determines that the failure of the drug was due to ignorance by the testers.

FRAMEWORK: ACTOR-NETWORK THEORY

ANT theory is a theoretical framework used in science, technology, and society (STS) studies that can prove effective for constructing and analyzing the thalidomide case by allowing the components of the network to be taken apart and examined individually. ANT assumes that social networks are not composed of pre-existing entities, but are instead continuously produced and enacted through the interactions of humans and non-humans, such as technology, objects, and institutions. According to ANT, these interactions are not unidirectional, but instead create a

feedback loop, where the actions of one actor affect the actions of others, leading to a constantly evolving network of actors. ANT also argues that there is no inherent difference between human and non-human actors, and that they are equally important in shaping networks. Actor-Network theory characterizes a network builder that identifies a problem and then uses both human and non-human actors to solve this problem (Cressman, 2009). The process of creating and maintaining an actor network is known as translation (Callon, 1986). Translation consists of four steps. The first of these steps is problematization, which is when the network builders recognize a problem and the actors required to solve the problem. Next is interessement, where the network builders find and engage the human and non-human actors to the network. Third is enrolment, where the actors are assigned roles to then perform. Finally is mobilization, when the network builder establishes their role as the spokesperson for the actors.

In Actor-Network Theory (ANT), translation refers to the process by which different actors are connected and mobilized to create a network. Translation involves the negotiation and alignment of interests, as well as the creation of common meanings and shared objectives between different actors. The process of translation is not linear, but rather iterative and ongoing. Different actors can be brought together in various ways, depending on the specific context and objectives of the network. ANT emphasizes the importance of tracing the history of translation in order to understand how a network has been created and how it functions. By examining the process of translation, different actors involved in the thalidomide network can be identified, as well as their relationships, power dynamics, and the conflicts that may exist within the network.

ANALYSIS OF THE DRUG ACTOR-NETWORK

Thalidomide producers and distributors deceived the public by releasing and marketing a product that was not acceptable for release. These social and technical actors failed the network

by building it in a way that was unsafe for other social actors in the networks, being the users and the victims of said product. This analysis will demonstrate the failure of the thalidomide testers and distributors by analyzing research articles as well as interviews with victims.

Network Formation

The network itself is built of a variety of components. However, the most notable actors in the network are technical, social, and conceptual. The technical actors are the ingredients in the product and the infrastructure of labs and the drug testing system (ACS, 2014) (Botting, 2015). The social actors played a huge role in building the network of the drug and its distribution. This includes the company that developed the drug, as well as the FDA, and the users of the product. The developers and testers of the drug failed the public by releasing an extremely dangerous drug that caused the deaths of thousands of newborn children (Evans, 2014). These were mostly employees of Chemie Grünenthal, which is another social actor. The FDA played a crucial role in the regulations they had in place (Kim 2011). This actor clearly changed their guidelines after this disaster, but their lacking regulations were a key component in the failure of the actor that had to distribute the drug. The users of the products were the actors that were directly affected by the drug. These actors were primarily pregnant women in their first trimester. It can also be said that the children born were other actors, as they were affected by the drug and those that lived had to live their lives with severe deformities (Thomas, 2020). Finally, conceptual actors were also important in building the network. Conceptual actors involve the engineering and marketing decisions of the testing and distribution company (Science Museum, 2019). Additionally, ideas about the drug and the way that enantiomers may affect the final product was another conceptual actor that failed to be understood by some of the social actors (ACS, 2014).

Testing fallacies

The developers of the drug working for Chemie Grünenthal failed the network by using testing methods that negatively affected other actors in the network. Specifically at the time of the development of this drug (1950s), women were treated very differently by the healthcare system. This is reflected by the treatment of distributing this drug. As previously stated, the developers and testers did not think to test on people that were in their target user group. In fact, they completely chose to exclude pregnant animals and women from their testing (Botting, 2015). This seems like less of an oversight, and more of a conscious choice to get a drug out into the public without checking the validity of the product. The actors did not take into account how their product would affect other actors in the network, and especially decided to ignore the legal actors as well as the female users. Here it can be seen that the translation step of enrolment failed and caused the downfall of the network. The network builders had recruited actors that failed to perform their roles properly. The human actors failed to take into account the consequences of their performance in developing and distributing the drug, leading to the catastrophe. Additionally, the non-human actors recruited by the network builders were not fully understood at the time of the decision and led to a failed product.

Furthermore, the actors failed to take accountability for their actions and evaded justice (Evans, 2014). There was a criminal trial of the employees of Chemie Grünenthal that was promised to deliver justice to the victims' families. The company had stated that the abnormal births were "an act of God"; however, after the examination of thousands of cases were studied, a bill of indictment was written against nine major Chemie Grünenthal employees. There were hundreds of people and thousands of pages of evidence written up against the company.

However, the company's army of lawyers helped them to go free, despite their actions against other actors in the network (Evans, 2014).

The failure of the network was in part due to the developers and testers of the drug, working for Chemie Grünenthal. The network builders identified and recruited actors to perform specific roles in the network in order to release a safe drug to prevent morning sickness. However, these actors were not successful in their roles and should not have been brought into the network, failing the enrolment step of translation.

An alternate viewpoint would be to blame the FDA for their lack of guidelines in terms of drug testing. While this may have only affected the distribution of the drug in the United States, this still gives a viewpoint into a large market for Thalidomide given the 2.5 million pills distributed to doctors throughout the United States (Kingsland, 2020). At the time of the distribution of the drug, trials did not require FDA approval or insight. Therefore, drug testing was under less scrutiny and were more likely to make it to market in a hasty manner, taking the blame off of Chemie Grünenthal management and employees.

This view fails to consider the insufficiency of women's healthcare to this day. Mifepristone is a pill that aids in providing a safe medical abortion in the early stages of a pregnancy. This pill has been used safely by women all around the world for decades. However, on April 7, 2023, "Judge Matthew J. Kacsmaryk issued a preliminary ruling invalidating the Food and Drug Administration's 23-year-old approval of the abortion pill mifepristone" (Belluck, 2023). This case shows that even in 2023, there have been actors that have failed to consider the well being of women, despite the regulations or culture of the time. Chemie Grünenthal created one of the largest medical tragedies of all time by ignoring women in the healthcare system and not taking pregnancy into account when testing the drug.

Victims

There were thousands of infants born with birth defects that led to death, short lives, or complications throughout their lives as actors impacted by the network. There have been accounts of the living "thalidomide babies" and how they proceeded with their lives after the drug essentially made them more difficult. In the case study of a girl, Carolyn Farmer Sampson, born with thalidomide-related defects, it can truly be seen how the victims were impacted. Sampson was born with short arms and had missing fingers. Growing up, her family hid her defects with props when taking photos, and tried their best to shield the public from her appearance (Thomas, 2020). Carolyn Sampson had trouble finding a job when she grew up, as no employers wanted her due to their belief that her disability would impede her ability to properly finish tasks. She was consistently wrongly accused of making errors at her jobs, and was mistreated by many employers. Carolyn Sampson discovered why she was born with defects and went on a path to sue the actors that caused her life to be so challenging. She got in touch with lawyers and they were planning to sue Grünenthal, which is still in business, as well as other companies involved in the scandal. This did not gain much traction and ultimately yielded no results. In 2018, many thalidomide survivors met and decided to form a nonprofit: US Thalidomide Survivors (Thomas, 2020). This campaign was initiated to bring awareness to survivors of the thalidomide tragedy and to gain traction in finding doctors that were responsible for selling the drug to pregnant women. In this case, actors that had been affected by the drug for decades finally decided to build on the network and form new connections between actors. By doing this and by increasing drug testing laws, the network continues to develop and finds ways to improve upon the actions of previous actors. This is a case of the mobilization step of the translation process affecting the trajectory of the network. Originally, the human actors were

tragically betrayed by the network and therefore, represented the fact that the system was a failure. These victims have acted as spokespeople against the drug and the formation of the network, as opposed to how mobilization is meant to work. However, actors affected by the drugs mobilized the network and became spokespeople for increased drug testing and regulations, highlighting the few positive consequences of the tragic downfall of the network.

CONCLUSION

In this paper, actor-network theory was used to identify each actor and determine how they failed the development of the network of the thalidomide drug. By determining how the social and technical actors impacted the network, I determined that this tragedy cannot simply be blamed on a lack of knowledge before the drug was sent out to users in the public. The exclusion of proper research and testing methods were clear indicators of the way that women have been treated in health care in the past. While progress has been made, similar situations can be seen where drugs and products have been released to benefit only specific groups of people. Engineers and scientists are responsible for the safety of the network they build and must ensure that they take all measures necessary to provide a network that properly interconnects all actors within that network.

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