Cyclical Marginalization of Social Groups in Triage Systems

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2020

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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Abstract

No technology addresses all current and foreseeable issues within society, especially those within the medical field. The technological or social constraints that define technological success in a society simultaneously define the constructs that marginalize social groups. The aim of this paper is to analyze how technology developed to optimize a specific social group's health outcome simultaneous lacks the ability to address all patient types, generating cyclical health disparities. The reason for this inequity may be the resultant of a conscious or implicit bias, or similarly a lack of constraint discovery in the design process. No matter the reason for marginalization, the cyclic production of problems still exists. Technology designed to enhance the triage system was chosen for this analysis as it is representative of a healthcare process where all patient types are subjected to the system. The triage system, a knowledge system experienced by almost all social groups, consistently results in the production of a healthcare disparity despite its promising technological beginnings.

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Introduction

A countless number of patients are unable to receive the personalized care needed to reach optimal health. Despite the promises of new policies and technology, equivalent levels of care for everyone will never be achieved. To design a new medical device, engineers often follow a design process that defines constraints and relies on iterations to produce a meaningful and novel device. This very process evaluates available medical knowledge and technologies of a specific issue and then establishes a hierarchy among them.

However, no technology addresses all current and foreseeable issues within and of society. The inability to address all patient types creates marginalization and inequity in a healthcare. The social construction of technology (SCOT) theory establishes design constraints and weights the needs of various patient populations tailored to the individual group's needs. SCOT theory stands on the three basic tenets: knowledge is constructed and not innate, relative social groups form interpretations from this knowledge, and a point of stabilization among these social groups is reached (Pinch, 1984). As social groups form interpretations, they are hardly ever the same, meaning there is interpretative flexibility among the groups.

Despite the range and plurality of needs between these social groups, a single technology is often adopted to meet the needs of only the majority. In other words, a technology is biasedly developed to meet the ideal solution of only a portion of the population. This leaves unmet clinical needs to be solved at a later time in a new design process.

During the design process, the acknowledgement of current technology's shortcomings backs the reasoning for a new superior technology. The movement from one technology to a more superior one, induces a social technical pattern that follows technological determinism (TD) theory. SCOT and TD may seem similar in that new technologies are continuously produced to solve previously unmet needs, generating a cyclical pattern for innovation. However, a key difference lies in the focus of why the technology is generated. TD directly relates to superiority of science, technology, and knowledge over previous versions. SCOT is focused around the dynamic needs of social groups. In this way it is paradoxical to think that developing a technology with the intent to provide unmatched care for people can actually drive a wedge further towards the generation of health disparities.

The aim of this paper is to analyze the production of health disparities through the development of technology despite the focus on social good in the design efforts. To conduct this analysis, technology developed to optimize the patient triage system will be analyzed in relation to the context of social production of technology to demonstrate the cyclic nature of marginalization and health care disparities.

Methods

Social Construction of Technology Analysis

The three tenets of SCOT theory are identified in the healthcare technology being analyzed. Constructed knowledge throughout this paper can be referenced as the usage of scientific and medical models, prognosis predictions, and social/cultural health indicators.

The social factors in control over the technological and scientific development within a healthcare field can be outlined by the relevant social groups that hold stake in a healthcare setting: the patient, medical practitioner, healthcare facility, medical device company, etc. Each of these groups formulate their own interpretation of an event facilitated by this role society assigned to them.

Generally speaking, patients want to better their own health with as little cost as possible, economic and/or physical. Medical device companies, healthcare facilities and medical practitioners want to facilitate healthcare while maintaining a functioning budget and keeping individual people, whether it be patients, workers, business partners, happy. The need and creation of new technology comes about as the relevant group's aims reached a point of stabilization. Interpretive flexibility among the social groups often times leads to multiple solutions to many versions of one problem.

The purpose of this analysis is to understand how the selection process of one solution hinders the progress of another social group due to a not all-encompassing solution.

Patient Triage System

The triage system was chosen for this analysis as it is representative of a healthcare process where all patient types are subjected to the system. A triage system is used by healthcare practitioners to determine which patients should receive care first, based on their clinical status, the prognosis of disease, and available resources. (Baciu, 2017) Typically, there are prescribed criteria a medical practitioner screens for to determine the ranking. These criteria include things such as if a life saving measure is needed, a patient's heart rate, self-reported pain intensity, pulse, respiratory rate, age, sex, system/organ of complaint, etc.. Triage systems are most commonly used in healthcare settings that has a large volume of patients with various conditions, such as emergency departments or urgent care centers.

As a contrast of design scope, a case of technological innovation designed specifically for a certain patient subtype will be analyzed using SCOT such as the design of an automatic external defibrillator. This case highlights the few differences in a sociotechnical outcome following the introduction of the new technology.

Generation of Bias by Triage Systems

Bias in Triage Algorithm

An algorithm, called Optum, was developed to guide health care professionals to decide which patients would need more intensive medical support. Optum's algorithm was designed to mitigate unnecessary costs for both the patient and healthcare system as a result of the incentives created by the Affordable Care Act. Essentially, it is in both the provider's and patient's best financial interest to get healthcare on a regular basis rather than waiting until they are ill. The algorithm's job was to identify the patients who were at greatest risk for becoming very sick and weighing those patients as more important than less risky patients. A sum of previous medical expenditures of an individual patient was used as the metric to quantify the health risk of a patient.

Despite Optum being designed to exclude race as a metric of risk, the technology inherently contributed to the racial health care disparity already existing within the U.S. healthcare system. Ziad Obermeyer, an acting associate professor at the Berkeley School of Public Health, the lead researcher on the study detecting the bias states: "Cost is not a "race-blind" metric, and using it as a screening tool for high-risk patients led to the disparity the researchers found in Optum's algorithm because, for one reason, black patients access health care less than white, wealthier patients do. Black patients spent $1,800 less in medical costs per year than white patients with the same chronic conditions, leading the algorithm to conclude incorrectly that the black patients must be healthier since they spend less on health care." (Gawronski, 2019) When the company initiated an analysis on a national data set of 3.7 million patients, they found that black patients who were ranked by the algorithm as equally as in need of extra care as white patients were much sicker: collectively suffering from 48,772 additional chronic diseases. (Washington Post, 2019)

From a TD theory standpoint, this technology offered a reduction of superfluous hospital costs by promoting preventative care rather than consistently treating ill people. Previous technology has simply treated the sickest patients first, rather than seeking out the patients who have the potential to be the sickest (Washington Post, 2019). However, because of the racial disparity within the system's algorithm, its relation to health and cost reduction are not equivalent. If patients are treated for their conditions with an equal price despite demographic, initially the checkbooks would be balanced. However, the goal of keeping healthy people health would not occur. Ultimately resulting in more sick people, increasing the costs in the future.

From a SCOT theory prospective, elimination of some expenditures and illness severity among patient population can be considered a shared goal among, patient, practitioner, healthcare facility. However, in reality can all patients be assumed that they will seek medical attention at the same rate, or that cost is a demographic free measure? As stated previously, wealthy, white people tend to seek out healthcare more frequently than any other demographic, biasing the system (Washington Post, 2019). It is worth noting that most health care providers, fall within this category, making it unlikely a fault is noticed during a change of roles. The stabilization among groups of this algorithm's design was made without the consideration of dissociations among patient groups. It obvious that if cost is the only factor between a patient receiving health care immediately verses waiting for care, people that can afford to pay for immediate care will. Those who cannot spend as lavishly will wait, sometimes until it is too late, even until their condition has become to require extensive life saving measures.

Despite the slight agreeance in a common goal in all social groups from a SCOT perspective, as well as the initial promises of a TD prospective, this triage algorithm produced unequal care for all patient types. In order to fix this inequity, the factors that led to this technology's downfall will have to be accounted for in a new design. In an entrepreneurial environment, the unmet need is often exploited and often serves as the eye opening "significance" establishing capitalist interest.

Heightening the quality of patient care within health care facilities has repeatedly footed the motivation for developing new medical devices. It is thought that developing and using state of the art technology significantly increases the capabilities of medical science. However, it is unclear what defines quality. Most of the time the answer lies within a normality of society. Quality itself is not a single entity and depends on the social determinants of health (income, social status, education, gender, race, accessibility to healthcare. etc.), which is determined on a case by case basis within the medical field.

Despite the obvious variations of standards of care that arise tailored to a specific determinant of health, construction of universal quality standards are deemed necessary in a healthcare institution. Universal standards are established to hold health care professionals accountable for their work, generating a system of trust between patient and the healthcare institution. Often, the shared goal between the health care institution and patient population is to increase the likelihood of a desired health outcome, avoiding death, disease, discomfort, and dissatisfaction. However, how are we sure this new design is not producing an inequity the designers are not aware of? Does this mean the previous method of functioning off of the present most sick person is the fairest protocol?

Bias Within Emergency Severity Index System

From the evaluation within the design experience, it can be assumed that healthcare disparities are a result of unequal considerations of various social groups. Unequal consideration when implanted in a system or technology can simply be termed, bias. Differences between social groups, often based on demographics such as race, ethnicity, gender, sexual orientation, age, disability status, etc.. have been studied as a predictor of an individual's ability to achieve optimal health. (Healthy People 2020, 2016) It is unethical to apply more weight to a patient’s outcome solely based off of an uncontrollable characteristic. Correlational evidence indicates that biases are likely to influence diagnosis and treatment decisions and levels of care in some circumstances. (Fitzgerald, 2017)

The Emergency Severity Index (ESI) scores are widely used to prioritize the patients in the emergency department (ED). They are often perceived and relied on as predictors of required hospital admission and resources needed for the treatments of the patients. (Vigil, 2016) To obtain an ESI score of a patient, a medical practitioner takes a patient’s vitals: heart rate, respiratory rate, pain intensity, and pulse. These features are commonly thought to be representative of the severity of a patient’s current condition. Pain intensity is often a required vital, however not required to run an ESI score. (Vigil, 2016) The pain intensity can and often influences the medical practitioner’s interpretation of the ESI in the final decision of triaging patients. Thus, the discretion of the system is subject to the interpretation of the medical practitioner analyzing the comprehensive data.

One study examined mechanisms that could potentially contribute to health disparities in patient care using over 350,000 patient-provider encounters by examining two types of personlevel factors: patient-driven and provider-driven. (Vigil, 2016) Essentially, the study utilized information from an ESI score (including pain intensity) to study if disparities are a result of patient variations or as a result of provider's impressions. The study found that the individual differences between patients (patient-driven mechanisms) accounted for a greater amount of variance than differences between nurses (provider-driven mechanisms) for patient-reported pain levels and heart rates. (Vigil, 2016) However, provider's impressions accounted for more variance than patients for the respiratory rates. (Vigil, 2016) Likewise, the results suggest that the non-Hispanic white patients may have received prioritized treatment (more severe ESI scores) as compared to African-American patients when lower levels of pain were reported. (Vigil, 2016)

Similarly, as the triage algorithm, the SCOT theory prospective offers the idea that establishing a non-biased system that ranks illness severity among patient population can be considered a shared goal among, patient, practitioner, healthcare facility. However, as seen in a system built off of scientific knowledge and is free to be interpreted by various medical practitioners, bias is still present. Despite the absence of an algorithm making decisions based off of what one can describe as an initially biased system, the stabilization among groups was made without the consideration of dissociations among patient groups. Ethnic disparities in the ESI score interpretation contributes to disparities in patient outcomes. As a result, this could lead to increased costs as more follow-up visits are required due to a lack of immediate attention to a severe illness.

Stability reached among these groups ends with one group's interpretation not equally weighted with the majority patient population. In attempt to create new devices focused to alleviate the health disparity created by the original technology, further groups are excluded. Thus, patient treatment becomes specialized by patient type to best treat the situation. However, as advancement continues, that patients who are not designed for in the system has to jump through larger hoops.

Automatic External Defibrillators

The past two examples detailed technology and knowledge systems relevant to all patient types. Often times in the medical field, medical devices are designed for a specific patient population or health criteria. In the case of sudden cardiac arrest (SCA) the heart unexpectedly stops beating. This is usually caused by an abnormal, erratic, heart rhythm called ventricular fibrillation (VF) or a fast contraction called ventricular tachycardia (VT) both resulting in little to no blood flow out of the heart. If not treated immediately, the heart will stop completely, resulting in death. The only effective treatment for SCA that occurs out of the hospital, is an electrical shock called defibrillation from an automated external defibrillator (AED). The electrical current applied to the chest passes through the heart, stopping the VF/VT and providing an opportunity for the heart's normal rhythm to return.

An AED is most commonly used in out of hospital sudden cardiac arrests (OHSCA). This device from a TD standpoint offers a largely simplified version of an advanced procedure on any unfortunate person that is experiencing a SCA. However, this device lacks in its ability to recognize SCA patterns beyond VF or VT rhythms, potentially limiting its effectiveness. However, from a SCOT perspective, the largest inhibitor of this device is the ability of a bystander to access and initiate the use of the device properly. In contrast to the previous triage systems, this device does not rely in any way on the demographics of the patient experiencing a SCA. The triage system of this device is purely based on the scientific knowledge and medical system of the heart’s electrical rhythm. Thus, how can any group be marginalized by a biased treatment.

Given the limitations of the device, the user of an AED is the biggest predictor of a patient's outcome, often reliant on the knowledge a person gathers during a CPR class or from the infograph on the device during the SCA.   A study was conducted on 9022 individuals who completed the survey a survey following having to use an AED on a SCA patient. Of those individuals, 68% had never been AED trained. Additionally, self-identified non-Hispanic whites and blacks were more likely to have AED training compared to Latinos. Additionally, higher educational individuals were associated with an increased likelihood of training. This study lacked analysis on patient outcomes, however it outlines how knowledge disparities exist within demographics. The Ontario Prehospital Advanced Life Support (OPALS) study, analyzed the survival rate of OHSCA before and after the implementation of an AED training program targeted at firefighters and police officers. The survival rate was 3.9% before the program's implementation and 5.2% after the implementation. (Medical Advisory Secretariat, 2005)

An increase of training yielded higher survival rates, however the increase of the rate relative to the likelihood of a patient's survival is not impressive. In this case, social groups being educated can make a difference in a survival rate, however the limiting factor is largely the capabilities of the device. Capabilities of the AED device are not independent of medical knowledge, and so more detectable patterns are needed to enhance the treatment of an AED. However, if the capabilities are expanded through more research and design efforts, the device is no longer limited by its own capabilities. The disparities in amount of AED training held by various social groups will play a larger role in patient survival, leaving a new problem to solve targeted at specific social groups.

Conclusion

No matter the that technological or social constraints that define technological success in a society, these constructs marginalize new social groups and generates new problems for society. In this paper, patient triage systems of various technological development were analyzed in relation to the social production of technology to demonstrate the cyclic nature of health care disparities. The triage system, a knowledge system experienced by almost all patients, consistently resulted in the production of a healthcare disparity despite its technological beginnings. The Optum system designed for little to no influence from a medical practitioner still implemented cyclical bias in treatment protocol. AEDs and ESI are both influenced by the users of this technology, implanting bias not intended by device designers. It is obvious by this analysis; no technology addresses all current and foreseeable issues within and of society.

The inability to address all patient type variations creates care inequity in a healthcare setting as the needs of various patient population are weighted differently. The reason for this inequity in weight may be the resultant of a conscious or implicit bias, or similarly a lack of constraint discovery in the design process. No matter the reason for marginalization, the cyclic production of problems still exists. To address these unmet clinical needs, future design iterations must focus on the flexible interpretation of the social groups that have been marginalized by the current design systems.

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