

## The Impact of Patent and Regulatory Laws on the Propagation of Medical Products to Various Countries

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### Abstract

Has anyone ever wondered how people abroad have access to medical products developed in the United States? What are the processes that medical products have to go through in order to be distributed in a foreign country, and what affects the distribution? These are all questions that served as the basis for the Science, Technology and Society project on how regulatory and patent laws affect the propagation of medical products to various countries. This project was tackled through a comparative analysis of regulatory and patent laws in the US and South Africa and an analysis of how their systems would impact the transfer of HIV/AIDS treatments and diagnostic tools from the US to South Africa. The STS framework of civic epistemology was selected to perform the comparative analysis. The approach of the paper was to: 1) define civic epistemology and the context in which it was being used for this project, 2) discuss patent laws for the US and South Africa, 3) compare US and South Africa patent laws through civic epistemology, 4) discuss regulatory laws for the US and South Africa, 5) compare US and South Africa regulatory laws through civic epistemology, and 6) use each country's laws to understand what affects the transfer of HIV/AIDS diagnostic tools and treatments from the US to South Africa. In the end, it was discovered that regulatory and patent systems can impact the availability of medical products distributed and marketed within a foreign country.

## Introduction

Medical technology and pharmaceutical industries are some of the largest markets in the world. In fact, the global medical technology market is valued at around 430 billion dollars, which, as of 2017, is more than the GDP of every African country (Statista, n.d.-b) (The World Bank & OECD National Accounts, 2017). In 2014, pharmaceutical companies earned revenues exceeding one trillion dollars worldwide (Statista, n.d.-a). These statistics illustrate the large impact that these industries have on the global population and economy. It also makes one consider how medical products are introduced in other countries and how each country's laws can affect the sale and distribution of medical products.

This paper will specifically explore how patent and regulatory laws in two countries, the US and South Africa, affect the propagation of medical products through the STS framework of civic epistemology. The US was considered for this paper as its systems were developed before many other countries' systems. Furthermore, the developed systems of the US may have encouraged other countries to use these systems as a template. South Africa was considered for this paper as its regulatory and patent laws indicate similarities to US laws, but South Africa has also created and modified its systems to cater to the needs of its people. Moreover, this country has recently exhibited growth in the pharmaceutical and medical technology industries and high demand for medical products ("South Africa—Medical Devices," 2019) (Department: Trade and Industry, 2017).

The general outline for this paper is to first discuss patent and regulatory laws for each country and analyze these laws through a civic epistemological lens. After, this paper will analyze the effect of these laws on the transfer and distribution of HIV/AIDS diagnostic tools and treatments

## Civic Epistemology

First, it is imperative to define and evaluate the STS framework of civic epistemology in relation to the questions explored in this paper. Civic epistemology was developed by science and technology expert, Sheila Jasanoff, who defines civic epistemology as "a stylized, culturally specific way in which the public expects the state's expertise, knowledge, and reasoning to be produced, tested, and put to use in decision-making." (Sheila Jasanoff, n.d.).

Essentially, Jasanoff argues that the public has faith in

its government to make sound and beneficial decisions for them based on logic, research, and evidence. Nevertheless, if the public deems the work and efforts of the government unimpactful or unnecessary, the government will most likely change its path to avoid being viewed as irrational or illegitimate by the people. Furthermore, Jasanoff introduces five interrelated dimensions of civic epistemology that is relevant to each country: dominant-participatory styles of public knowledge-making, the methods to ensure accountability, public demonstration practices, the preferred registers of objectivity, and the accepted bases of expertise (Sheila Jasanoff, 2007). These five dimensions can be applied to medical technologies present within a specific country. Civic epistemology is used as the STS framework for this paper as it allows for a comparative analysis of regulatory and patent laws in the US and South Africa.

### Intellectual Property (IP)- Patents

Most countries have laws pertaining to IP. A patent is a type of IP protection that can be extended to medical products. A patent is defined as an invention, which is classified as a process, method, machine, device, new material, chemical compound, or chemical composition (Intellectual Property Office, 2016). Every country has a distinct process for filing a patent. To understand the similarities and/or differences between the patent systems in the US and South Africa, this paper will follow the process and laws that affect the filing of a patent by a business in the US and in South Africa.

### US Patent Law

In the US, a business that desires to patent a medical product would first submit a patent application to the US Patent and Trademark Office (USPTO) created by the US Patent Act. If another business submits an application for a similar medical product as the original business, then USPTO would grant the patent to the business that applied first, barring a public disclosure. This first-to-file system was introduced after 2013; previously, the first-to-file system was superseded by a first-to-invent system. (Office of Patent Quality Assurance, 2016). Once an application is submitted, an examiner evaluates the application and reviews previously filed patents to see if the submitted product is similar to a prior one. Moreover, if a medical product is introduced into the human body, the examiner will evaluate preliminary evidence submitted by the business to corroborate the product's efficacy. The examiner will grant a patent if the product is novel and non-obvious,

meets subject-matter eligibility requirements, and has evidence to support its use. However, ambiguity surrounding the subject-matter eligibility requirements and the ruling of the Supreme Court case *Mayo v. Prometheus* have allowed for some medical diagnostic technologies to not be granted patents. In fact, medical diagnostic applications saw rejections rise from 7 to 32 percent after the ruling and eventually climbed to 64 percent (Chien & Wu, 2018). Nevertheless, if a patent is granted, the filer will be notified, and the patent will be displayed on the USPTO website (Office of the Chief Communications Officer, 2014).

The US is a signatory of the Paris Convention; therefore, foreign businesses can and must file for a patent in the US if they desire protection (United States Patent and Trademark Office, 2018). Furthermore, many universities and researchers are able to submit patents. The US Bayh-Dole Act passed in 1980 grants ownership of inventions to US universities and researchers, even if they were developed with government funds (Cloete, Nel, & Theron, 2006). The passage of this act resulted in an exponential increase of the number of patents granted to universities.

Moreover, it was estimated that there has been a ten-fold increase in the number of universities pursuing research-based patents (Levenson, 2005). Thus, it can be inferred that the Bayh-Dole Act has galvanized many research institutions to continue to develop critical medical products.

### South African Intellectual Property

A business filing a patent in South Africa would experience a similar process as a business in the US. South Africa's Patent Act stipulates the rules and regulations for a business filing a patent. The act specifies that for an invention to be patentable, it must be new and capable of an application in trade, industry, or agriculture and must not be an obvious variation of a known technology (Intellectual Property Office, 2016). This rule parallels the US patent system's subject-matter eligibility requirements. In 2005, a unique amendment was added to the Patent Act that requires a disclosure by the patent filer on whether a product uses or is derived from an indigenous biological or genetic resource and whether the patent relies on traditional knowledge or resources (Cloete et al., 2006). South Africa still retains much of its tradition; thus, this amendment was passed to prevent businesses from profiting from traditional knowledge. Once a business has a medical product it wishes

to patent and abides by the rules set forth in the Patent Act and its other amendments, the business applies to the Companies and Intellectual Property Commission (CIPC) where an examiner reviews the application in a similar manner to the US. If the patent is approved, then it will be published in the Patent Journal. Like the US, South Africa is also a signatory of the Paris Convention; therefore, foreign businesses can and must file for a patent in South Africa (Intellectual Property Office, 2016). Moreover, similar to the passage of the Bayh-Dole Act, South Africa passed the Publicly Funded Research and Development Act 51 to allow state-funded university science to be patented and commercialized (Barratt, 2010)

### Intellectual Property and Civic Epistemology

Both countries have similar patent-filing processes. However, both vary in the how they fulfill the dimensions of civic epistemology. The first row for each dimension in Table 1 summarizes how each country's patent system fulfills each epistemological dimension. The next few paragraphs will expand upon what is in the table.

In the US, many individuals are responsible for contributing to the current patent system. They include scientists, engineers, legal experts, IT experts, the courts, etc. The government utilizes information from these groups to make informed decisions. The patent database updated by the government also serves to inform the public of approved patents, therefore, satisfying the first dimension of public-knowledge making. The second dimension, public demonstration, is exhibited through public access to all patents. Many of these products are also visible to the public through distribution. Next, patent examiners in the patent office are knowledgeable in patent guidelines, laws, and technologies as many examiners are scientists, engineers, or legal specialists (Mailänder, 2012). The dimension of objectivity can be seen through the USPTO's decisions on patents. The USPTO grants a patent to a business if the product follows guidelines and is the first to file. The last dimension that the US patent system upholds strongly is accountability.

Litigation and the USPTO are responsible for enforcing and protecting patents and for creating an accountable patent system. The USPTO derives its legitimacy from the belief that the office will grant a patent only for unique innovations and advancements in technology. During the patent's lifetime, the innovator controls patent rights. When the patent owner believes patent rights are compromised, the US law system will arbitrate the matter and will ultimately serve as a patent enforcer. This granter-and-enforcer system encourages the continued invention and development of medical products within the US. In contrast,

countries such as India and China that are not stringent enforcers of patents discourage businesses from filing and distributing medical products in those countries. For instance, China recently approved a copycat version of a cancer therapy that was developed by Onyx Pharmaceuticals, a US biotechnology company.

After this incident, Ernst & Young polled 348 senior pharmaceutical executives and found that these executives fear counterfeit products and unenforced patent laws in many developing countries such as China and India. As a result, businesses are reluctant to tap into these markets. This hesitancy is fortunately not a factor in the US; thus, many continue to file and distribute products within this nation (Brower, 2006). In general, countries like China and India do not satisfy all five dimensions, such as accountability or objectivity; therefore, their system lacks the same level of legitimacy as the US.

South Africa's fulfillment of these dimensions vary in a few areas as the priorities of this country are focused more on access to medical products and the prevalence of many diseases.

First, after many years, legal experts, researchers, the government, businesses, and others have had the opportunity to contribute to the patent system, satisfying the first dimension. Specifically, amendments have been added to consider various groups of people, specifically those who possess traditional knowledge such as natives, which is untrue for the US. Often times, the US IP system has allowed for the misappropriation of Native American traditions through its approval of trademarks and copyrighted works. Also, many tribes and communities see a lack of recognition and compensation when pharmaceutical firms sell medicinal treatments developed by these tribes (Shabalala, 2017). This is the result of the US IP system catering towards corporate interests and protecting the increased threat to public domain (Graham & McJohn, 2005). In addition, South Africa has passed amendments to protect those who participate in state-funded ventures. In fact, researchers' concerns about their inability to patent due to costs of innovation were heard through the passage of the Publicly Funded Research and Development Act 51 (Barratt, 2010). Much like the US, the enforcement of patents in South Africa occurs primarily through litigation and CIPC. The Court of the Commissioner of patents has primary jurisdiction to hear patent lawsuits (Luterek & Hahn & Hahn Inc, n.d.). Although South Africa's system is well developed, there have been instances where

South Africa has infringed upon patent rights in order to obtain affordable medical products for HIV/AIDS (Papaioannou, Watkins, Mugwagwa, & Kale, 2016). One instance is through the approval of parallel imports, which specifically violates South Africa's Patent Act. Parallel imports allow for South Africa to import cheaper generic drugs, even if a company was granted a patent by South Africa (Fisher & Rigamonti, 2005). The issue surrounding the legalization of parallel imports will be further discussed in the South African regulatory law section. Regardless, decisions made by South Africa have caused pharmaceutical companies to mistrust the South African patent system. The South African government has indicated that its priority is to allow for its people to access affordable medicines; thus, the South African government is directly accountable to its constituents rather than the companies who file for a patent in this nation. Again, similar to the US, public demonstration practices in South Africa are published in the Patent Journal to allow the public to view approved patents. Also like the US, public demonstration is satisfied through product circulation. Unlike the US, the South African patent system can be labeled as subjective based on the parallel imports argument introduced earlier in this paragraph and its preference towards affordable generic products (Papaioannou et al., 2016).

As years have progressed, more experts have been involved in the process of improving and strengthening patent laws. During the rule of President Thabo Mbeki (1999-2008), the government would often ignore and deny scientific evidence provided by experts on HIV/AIDS transmission due to its implication that South African men were hyper-sexualized (Baker, 2015). Due to modernization and the prevalence of HIV/AIDS and other diseases in South Africa, more efforts have been made to rely on experts. Consequently, many experts are employed as patent examiners. Examiners are required by CIPC to be knowledgeable in the technical field in which the filed invention relates (Zulu, Phosiwa, & Ncube, 2018).

### Regulatory Law

Patent laws were discussed and analyzed in the previous section. In this section, each country's regulatory system will be discussed and analyzed using the framework of civic epistemology. There are differences in regulatory laws for medical devices and pharmaceuticals, thus, when necessary, the differences will be identified.

## US Regulatory Law

The US Food & Drug Administration (FDA) is responsible for creating and enforcing regulations for medical products. The FDA is broken up into multiple departments to handle its various tasks (Food & Drug Administration, 2010). Employees in these departments include attorneys, biologists, consumer safety specialists, engineers, information technology specialists, medical officers, and pharmacologists (U.S. Food & Drug Administration, 2018b). The specific department responsible for regulating pharmaceuticals is the Center of Drug Evaluation and Research (CDER), while the specific departments responsible for regulating medical devices are the Center for Devices and Radiological Health (CDRH) and the Center for Biologics Evaluation and Research (CBER) (Food & Drug Administration, 2010) (Center for Drug Evaluation and Research, 2019). The regulation of medical devices is based off product risk level. There are three specific classes: I, II, III (U.S. Food & Drug Administration, 2018c). Class I typically has low to moderate risk, Class II has moderate to high risk, and Class III has high risk. Class I and some Class II products have general controls. Higher risk Class II products consist of special controls. Class III products (and some Class II products) require general controls and a Premarket Approval (PMA) (U.S. Food & Drug Administration, 2018a). Special controls include performance standards, post-market surveillance, patient registries, special labeling requirements, premarket data requirements, and guidelines (U.S. Food & Drug Administration, 2018a). A PMA is essentially a private license granted by the FDA, allowing a device to be marketed if it meets safety and efficacy standards (U.S. Food & Drug Administration, 2019a).

The regulation of pharmaceuticals is analogous to the regulation of Class III medical devices. Similar to Class III medical devices, new drugs must demonstrate they are safe and efficacious through meeting performance standards and data requirements (U.S. Food & Drug Administration, 2019c). Additionally, similar to a PMA, companies interested in selling and marketing a drug must file a new drug application (NDA) and be approved (U.S. Food & Drug Administration, 2019b).

Manufacturers also follow regulations set forth by the FDA. They are required to establish and follow quality systems (QS) in order to ensure that products continuously meet safety and efficacy requirements. QS for FDA regulated products are referred to as current good



manufacturing processes (CGMP). Many of the CGMP regulations are consistent with international standards, as uniformity is beneficial for the public and the medical product industry. In general, QS regulation does not stipulate how a manufacturer must produce a specific product, but rather it requires manufacturers to develop and consistently follow procedures. The FDA then performs routine audits to ensure that manufacturers are compliant with their QS (U.S. Food & Drug Administration, 2018d).

Although stringent regulations exist, the FDA still faces many challenges including pre-market regulation of new medical products, post-market follow-up of medical devices, and regulation of medical devices. First, the FDA has several expedited programs in order to approve medical products that can be used for serious and life-threatening conditions. These expedited or fast-tracked approvals require less pre-market data to prove safety and efficacy. However, these approvals are conditional, meaning that clinical efficacy must be proven after the initial approval, or approval can be withdrawn. Nevertheless, the FDA has failed to withdraw many applications that were lacking in post-market studies. Even in cases where approval was withdrawn, the FDA struggled to remove the product from the market or to prohibit off-label prescriptions. The second challenge is issues with post-market studies for medical devices. One investigation of post-approval studies for Class III medical devices found that only 19 percent of the required post-studies had been completed three to five years after approval. In general, the FDA struggles to enforce these post-market studies that are so crucial to determining positive and negative effects on additional population subgroups. The last challenge to be discussed involves clinical trial data for Class III medical devices. Clinical trials for Class III devices are criticized as being insufficient. Some patients have been exposed to unnecessary risks, and there have been recalls when certain Class III devices have been cleared for marketing. Consequently, stringent clinical data requirements and post-market evaluations can limit these risks (Yale Collaboration for Research Integrity and Transparency, 2017).

### South African Regulatory Law

Medical products that are registered in South Africa typically follow the Medicines and Related Substances Control Act No. 101 of 1965. Prior to February 2017, the Medicines Control Council (MCC) was relegated the responsibility of

regulating the safety, efficacy, and quality standards of human and veterinary medicines (Gouws, 2015) (Keyter, Banoo, Salek, & Walker, 2018). The MCC had no more than 24 members that were appointed by South Africa's Minister of Health (Keyter, Banoo, et al., 2018). Members of the MCC included experts such as doctors, pharmacists, veterinarians, and various types of scientists and projects managers (Keyter, Gouws, Salek, & Walker, 2018). General staffers who worked for the members were responsible for regulatory review, and many were external contractors that included pharmacists and people with postgraduate qualifications (Keyter, Gouws, et al., 2018). In 1997, a legislative proposal was supported by the Minister of Health to allow for the authorization of parallel imports of patented pharmaceuticals. The proposal for parallel imports was approved and added to the Medicines and Related Substances Control Act as 15C (Fisher & Rigamonti, 2005).

In 2012, the South African Health Products Regulatory Authority (SAHPRA) was proposed to replace the MCC in order to reinforce political will to establish a regulatory agency with operational autonomy and accountability (Keyter, Banoo, et al., 2018). Additionally, pharmaceutical companies, private clinical research organizations, academic clinical research groups, and civil society organizations complained of delays and backlogs in drugs' registrations, which they claimed hurt patient access to affordable drugs (Leng, Sanders, & Pollock, 2015). It was further revealed that the MCC could only process approximately 2,550 out of 4,700 applications per year. In fact, when the MCC transitioned to SAHPRA, SAHPRA inherited a backlog of around 16,000 applications (Keyter, Banoo, et al., 2018). Poor organizational and document management systems and a lack of performance contracts for external experts were responsible for the backlogs and negative evaluations. For instance, new active substance (NAS) application reviews through the MCC sometimes took more than four years, while other mature regulatory agencies' reviews would take approximately 10-16 months (Keyter, Gouws, et al., 2018).

Operational element	MCC	SAHPRA
Mandate	Human and Veterinary Medicines	Medical Devices and Complementary Medicines included
Organizational structure	Under-resourced:	Fully resourced:
	Outsourced expertise	In-house capacity
Harmonization initiatives	Limited scope for reliance mechanisms	Legal framework for reliance mechanisms
Quality management system	Informal implementation of QMS	Formal implementation of QMS
Document management System	Paper-driven	Electronic Document Management Systems-driven
Fee structure	Collection of fees by National Treasury	Retention of user-fees
Service delivery	History of backlogs	Improved timeliness
Stakeholder relationships	Stretched industry relationships	Transparency and accountability

**FIGURE 1:** This figure illustrates some key differences between the MCC and SAHPRA.

SAHPRA was created to be a public institution with an independent board chaired by a Chief Executive Officer (CEO) and a more organized governance structure (Leng et al., 2015). SAHPRA’s mandate includes more functions such as the regulation of medical devices. It also uses an electronic document system to organize paperwork and evaluations. The differences between the MCC and SAHPRA can be seen in Figure 1 (Keyter, Banoo, et al., 2018). Changes include a new quality management system (QMS) and a revised fee structure to increase fees collected. QMS allows SAHPRA to perform internal audits and quality checks. Furthermore, the elimination of external assessors will improve accountability and performance within this regulatory agency. The revised fee structure will increase resources to perform more evaluations and will address delays and backlogs. Both China and Japan have implemented a similar fee structure and have seen a several-fold increase in trained staff and a reduction in timelines (Keyter, Banoo, et al., 2018).

SAHPRA’s regulatory process is similar to the MCC in that it reviews the scientific, medical, and ethical issues for each application. A company seeking approval must include proof of safety, quality, and performance. If an application is approved, the medical product is included on the register. Similar to the US, SAHPRA requires that applications for all medical products (devices and pharmaceuticals) contain

clinical evidence, risk management, sterility of devices, quality management systems, and quality assurance.

Similar to the US, medical devices in South Africa are categorized based on a class system. Class A are low risk devices, Class B are low-to-moderate risk devices, Class C are moderate-to-high risk devices, and Class D are high risk devices (risk relates to patient or public health). Regardless of class, if a medical device is approved, SAHPRA must engage in post-market surveillance activities (Gouws, 2015).

The register of license holders is where those that possess a license are legally held accountable for products on the market. If a medical product is approved to be on the register, the manufacturer must obtain a manufacturer's license, distributor's license, and/or a wholesaler license to manufacture, import, export, distribute, and/or wholesale the product.

The rigor of the application and post-approval inspection for medical products is similar to the US. South Africa is hoping that SAHPRA will be able to rectify accountability and transparency issues that the MCC had in order to strengthen its regulatory process.

### Civic Epistemology and Regulatory Law

Both the FDA and SAHPRA have strong, meticulous systems for regulating the approval and distribution of medical products, yet both agencies have challenges that may affect the fulfillment of the dimensions of civic epistemology. Both SAHPRA and the FDA fulfill the dimensions of public-knowledge making, expertise, and objectivity. Manufacturers, companies, researchers, and other individuals involved in the distribution of a medical product are responsible for providing the regulatory agency information to make decisions on a product.

These agencies are also responsible for informing these companies of their approval status. If an approved product needs to be recalled or discontinued, then these regulatory agencies share this with the public. Next, these agencies have many experts involved in assessing products for approval. Although both agencies possess limited resources for handling all applications, they still carefully review applications. The varied and skilled assessors and the strict regulatory guidelines allow for the approval process to remain objective.

Both agencies struggle with accountability. Before the MCC transitioned to SAHPRA, the MCC struggled to review all applications, which resulted in a backlog and a delay in

the approval and eventual distribution of key medical products. SAHPRA inherited the backlog of applications, so it may be a few years before SAHPRA is no longer behind. Furthermore, the US struggles with maintaining rigorous clinical trial standards for Class III medical devices, reviewing and enforcing post-market studies for certain population subgroups, and regulating fast-tracked products. Both of these regulatory institutions are accountable to the people, and their failures indicate a failure in accountability. Public demonstration is evident through the circulation of products. The governments and people can infer that products in circulation are regulated by regulatory institutions. However, this is not always true as products that have failed post-market studies can still be distributed. As aforementioned, the US specifically struggles in permanently removing certain medical products from circulation. An example of this is through the fast-tracked approval of the drug Avastin (bevacizumab) for the treatment of HER-2 negative metastatic breast cancer. In 2011, the FDA withdrew approval for this drug as its post-market studies failed to demonstrate effectiveness. Nonetheless, Avastin continued to be on the market for other approved uses, and 60 percent of medical providers in oncology stated that they would continue to prescribe Avastin off-label to patients with breast cancer (Yale Collaboration for Research Integrity and Transparency, 2017). These examples exemplify how the FDA was unaccountable to the public and how the public demonstration practice of observation through circulation may be flawed in the US. All of this information is summarized in Table 1.

TABLE 1: This table summarizes some of the main arguments on whether each country's patent and regulatory laws fulfilled the five dimensions of civic epistemology.			
Dimensions	Type of Law	United States	South Africa
<b>Public-knowledge making</b>	Patent	Those involved in generating relevant facts and claims to share with the patent office and government include scientists, researchers, engineers, legal experts, IT experts, courts, etc. The government, in turn, shares the passage of patents through a public patent database.	Those involved in generating relevant facts and claims to share with the patent office include scientists, researchers, engineers, legal experts, IT experts, courts, etc. The government, in turn, shares the passage of patents through the public Patent Journal.
	Regulatory	Those involved in generating relevant facts and claims with the FDA include scientists, researchers, engineers, legal experts, courts, manufacturers', etc. In turn, the FDA shares information about products that fail to meet regulations or product risks.	Those involved in generating relevant facts and claims with the FDA include scientists, researchers, engineers, legal experts, courts, manufacturers', etc. In turn, SAHPRA shares information about products that fail to meet regulations or product risks.
<b>Accountability</b>	Patent	The US patent system is held accountable through litigation and the USPTO. The US is indirectly accountable to its people through its support of a robust patent system.	The South African patent system is held accountable through litigation and the South African Patent Office. However, South Africa is primarily accountable to its people, which has caused issues with patent owners.
	Regulatory	The FDA is accountable to the people and medical companies. They protect both and attempt to provide an opportunity for companies to innovate and develop protocols for manufacturing, but they also ensure that the public is not at risk. However, the US has seen failures in its post-market surveillance of medical products.	SAHPRA is mainly accountable to the people. They are looking to import generics. It has added 15C to its regulatory law to be able to import cheap medicine for its constituents. Some failures exist in post-market surveillance and in the review of applications.
<b>Public demonstration practices</b>	Patent	Patents are revealed to the public through a patent database that the public has access to and through medical products in circulation.	Patents are revealed to the public through the Patent Journal and through medical products in circulation.
	Regulatory	Sometimes products in circulation do not correspond to approved FDA products. The FDA needs to strengthen its ability to monitor and enforce removals. Also, the FDA displays information on their website for people to access.	Similar to the FDA, SAHPRA needs to be more vigilant of post-market surveillance of products.
<b>Objectivity</b>	Patent	This is achieved through the patent system in general. The patent is awarded to a new or advanced medical product, and it is a first-to-file system. Preliminary data is required for certain medical products.	South Africa's focus is on affordable products, thus the approval of parallel imports to increase the sale and distribution of generics results in a comparatively less objective system.

	Regulatory	The system is created to be objective and not discriminate between companies and individuals.	The system is created to be objective. Although more generics are utilized in South Africa due to its affordability, South Africa does not favor foreign generics over domestic generics in relation to its regulatory law.
Expertise	Patent	Patent examiners are scientists, engineers, or legal specialists.	Patent examiners are required to be knowledgeable in a technical subject that relates to the invention being filed.
	Regulatory	Regulatory experts are knowledgeable in a wide variety of areas and are capable of assessing a product and its compliance with regulatory law.	Regulatory experts are knowledgeable in a wide variety of areas and are capable of assessing a product and its compliance with regulatory law.

### HIV/AIDS Case Study

The material introduced in the previous sections will be used to explain impacts on the propagation of HIV/AIDS diagnostic tools and treatments from the US to South Africa.

#### Background

South Africa has the largest HIV epidemic in the world, as it contains approximately 19 percent of the HIV global population. In 2016, South Africa had 7.1 million people living with HIV, 270,000 new HIV infections, and 110,000 AIDS related deaths (Intellectual Property Office, 2016). Main modes of HIV transmission include intercourse and vertical transmission (mother-to-infant transmission). In sub-Saharan Africa, women account for 58 percent of the total number of people living with HIV. Women are more affected than their male counterparts due to their inability to negotiate current HIV prevention options of abstinence, behavior change, condoms, medical male circumcision, or early treatment initiation in their relationships.

Additionally, the sub-Saharan region consists of the highest number of children living with HIV and the highest number of deaths related to AIDS (Kharsany & Karim, 2016).

There exist three main phases of the HIV infection: acute (primary), chronic (asymptomatic), and AIDS (final stage). Acute phase begins two weeks after the transmission of the virus. At this stage, the virus is highly transmissible. The infection can be detected at the two-week mark through an HIV

antigen p24 diagnostic test, a nucleic acid diagnostic test that tests for HIV RNA, and an HIV antibody diagnostic test. Additionally at this phase, an immune cell called CD4 drastically decreases, limiting the body's ability to fight this infection. During the chronic stage, HIV continues to multiply, and the CD4 count continues to decrease at a reduced rate. The virus is still transmittable, and without treatment, the infection will progress to AIDS in about ten years. Detection during this stage can occur through antibody detecting immunoassays. The last stage results in the progression of the infection to AIDS. During this stage, CD4 is reduced to less than 200 cells/mm<sup>3</sup>, whereas a healthy individual has a CD4 count between 500 to 1600 cells/mm<sup>3</sup> (Manoto, Lugongolo, Govender, & Mthunzi-Kufa, 2018).

Testing for HIV allows one to begin immediate treatment. From April 2010 to June 2011, 13.3 million South African citizens were tested through public health services (Johnson, Rehle, Jooste, & Bekker, 2015). People who fail to learn of their HIV status can attribute it to factors such as the long wait time to obtain results for certain diagnostic tests. For instance, standard testing for HIV antigen p24, HIV RNA, and an HIV specific antibody through ELISAs and



western blots takes many days to achieve results. Consequently, few patients return to testing centers to learn of their results. To address this issue, many have pushed for point-of-care (POC) diagnostics for patients. POC diagnostics must meet characteristics set by the World Health Organization (WHO). They consist of sensitive, specific, user-friendly, rapid and robust, equipment-free, and deliverable (ASSURED) diagnostics that do not require trained laboratory staff. Current Rapid POC tests use lateral flows that require few or no reagents, are cheap, and yield results within 30 minutes. These POC tests can generally detect antibodies of HIV from a small volume of blood, serum, plasma, urine, or saliva (Manoto et al., 2018).

HIV self-testing (HIVST) can be considered a type of POC. HIVST is defined as the process by which an individual can collect their own specimen of blood or oral fluid and perform HIV testing using an HIV rapid diagnostic test (RDT). The results can then be interpreted by the individual or assisted by a health professional. A positive result from a test would require the patient to follow-up with a health professional. The purpose of this test is to increase the number of individuals being tested for HIV and to motivate them to seek out a health professional in the chance that they receive a positive result. HIVST is a productive tool; however, the uncertainty surrounding the national policy impedes its entry into the South African market. This has inhibited manufacturers from distributing high-quality products. It has been recommended that specific national policies be changed to allow for HIVST including: laws permitting the sale, distribution, advertisement, and use of quality RDTs; an age of consent to self-test; human rights laws, policies, and regulations to protect individuals and address misuse of HIVST; national policies on how to confirm the HIV status; and quality assurance and post-market surveillance systems for these products (Venter et al., 2017). Considering the fatality of HIV/AIDS, typical treatment can transform it from a fatal disease to a chronic, manageable condition. Treatment options include antiretroviral therapy (ART) and antiretroviral vaginal (ARV) microbicides.

Additionally, preventative options include oral pre-exposure prophylaxis (PrEP) and peri coital tenofovir (CAPRISA 004 trial) (Kharsany & Karim, 2016). ART is used as the primary treatment to slow the progression of the infection (Fisher & Rigamonti, 2005).

## Discussion

From prior sections, it is clear South Africa has a well-developed patent and regulatory system, but there are areas in which they can continue to improve. However, what affects the propagation of HIV/AIDS diagnostic tools and treatments from the US to South Africa are the differences in priorities between the South African government and medical product companies both in the US and in South Africa.

South Africa is concerned with providing affordable medical products to its constituents, which can be achieved through generics. Consequently, South Africa's decision to add 15C (parallel imports) to the Medicines and Related Substances Act upset many pharmaceutical companies, thus an association of 39 pharmaceutical companies filed a case coined as *Big Pharma v. Nelson Mandela* (Papaioannou et al., 2016). These pharmaceutical companies claimed that 15C violated the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), disregarded patent rights as stipulated in South Africa's Patent Act, and allowed for compulsory licensing where the government can bypass a patent holder's approval to use that holder's patent. South Africa responded by arguing that these pharmaceutical companies were taking advantage of the impoverished such as the poor that are unable to pay the exorbitant prices for medical products; TRIPS was never violated as it does not prohibit parallel imports, and 15C never explicitly mentioned compulsory licensing (Fisher & Rigamonti, 2005). Eventually, the case was settled, but the relationship between the medical product industry and the South African government was damaged. Another instance that upset foreign and local medical product companies included South Africa's decision to terminate weak patents to allow for generics production. Companies argue that the termination would reduce innovation and fail to attract investment. These companies in response have partnered with a US based PR firm to advertise the negative repercussions of a "weak" IP system. This partnership further deteriorated the relationship between the government and the industry (Papaioannou et al., 2016). Although patents in the US can be invalidated through federal courts and the Patent Trial and Appeal Board (PTAB), South Africa's reasoning for invalidating patents is what could have negatively impacted relations (Inventor Resources, 2019). It can be inferred that South Africa's decision to terminate weak patents stems from the country's intent to increase the circulation of affordable generics.

Under the civic epistemology framework, South Africa's legitimacy in making decisions comes from its constituents; therefore, South Africa chooses to be directly accountable to its people. Patent owners desire an objective system; consequently, there are tensions between the government and foreign and domestic patent owners. Small additions to patent laws, which allow for generic products to be sold and distributed, appear to have a large effect on the propagation of medical products from specific companies in the US to South Africa. This becomes an issue when generics do not exist for certain ailments and diseases, thus depriving constituents of crucial products. Moreover, SAHPRA's application backlogs affect the ability for medicines to propagate to this country.

### Conclusion

Throughout this paper, the impact of patent and regulatory law is clear. A strong system can impact the transfer and distribution of key medical products. SAHPRA's inability to review all applications has led to a delay in the distribution of medical products, while its decision to not enforce certain patent laws has resulted in a lack of cooperation between the government and medical companies. On the other hand, the US is considered to possess a mature system, yet there are flaws in its system that can affect the health of patients. Thus, patent and regulatory laws must constantly be reviewed and improved upon in order to meet the needs of various parties.

Civic epistemology can be used to explain each country's differences in priorities and its impact on the propagation of medical products. The US caters indirectly to its people through the protection of laws and companies, while South Africa caters primarily to its people. It is argued that South Africa has stifled medical innovation and possesses a weak patent system. However, South Africa argues that it has been able to increase its constituents' access to cheaper generic medicines and testing. The short-term impact of increasing access may have long-term repercussions, as medical companies may choose to not distribute products within South Africa, thus depriving South Africans of necessary medical products. The impact of South Africa's decisions and its reforms must continue to be observed in the future. In general, understanding a country's patent and regulatory systems can assist in explaining the success in the transfer and distribution of medical products.

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