Chloé Lula: Honors Thesis, April 16th 2015

The Contextual Implementation of Health Technologies in Overdose Control and Hepatitis C Prevention

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Abstract

My senior honors thesis examines two public health issues – opiate overdose and hepatitis C – and explores the socioeconomic barriers barring patients from access to care, as well as the emerging forms of treatment that are making care increasingly accessible. In formulating my argument, I assert that traditional public health measures have failed to take the contextual factors of care into account for patients who come from limited-resource settings, and that there needs to be a greater emphasis on how to best implement health technologies to ensure their success in a real world environment.

Introduction

A paradox has emerged in the latter 20th century in which technology is blamed for increasing the cost of medical care and distancing physicians from patients, while also being credited with the relief of human suffering. Today, there is continuing tension between universal ideals and local practice as technologies are used differently by distinct populations, and as there is a continued existence of regional variation. There are multiple layers of meaning of "technology"; in the context of this research paper, "technology" can function as a physical artifact, as a means of accomplishing a goal, or as a measure of what people know[1]. My participation in an internship with the World Health Organization last summer as well as my tutelage under Dr. Caroline Acker over the course of my undergraduate career has exposed me to the need for

[1] Howell, Joel D. *Technology in the Hospital: Transforming Patient Care in the Early Twentieth Century*. Baltimore: Johns Hopkins UP, 1995. Print.

health policy measures that better address the implementation of health interventions in real-world settings, and particularly in low- and middle-income settings and among stigmatized populations. In this paper, I examine two groups of people in Pittsburgh specifically – those at risk of opiate overdose and those who are injection drug users at risk of contracting hepatitis C – and examine the emerging means of treatment that have facilitated care among these people. In my conclusion, I will present a set of suggestions for policymakers taking these issues into greater consideration. My year-long analysis of the lived experiences of individuals who use drugs as well as the existing sociopolitical frameworks in which healthcare policies are implemented will finally lead me to conclude that health technologies cannot be directly placed into any community or locale; instead, it is crucial to take the individual and environmental contexts of drug use into account to put effective and equitable health prevention systems into place.

Background: Early Opiate Use, Social Context, Understandings of Addiction, and Drug Overdose

Recent channels of research in health systems have examined the efficacy of implementation and the question of how to make technologies developed in hospitals successful and accessible for the populations in which they are used. Indeed, harm reduction approaches have long vied with federal policy strategies for quelling the risk of disease and overdose that accompanies opiate use, broaching the question of how to best execute outreach programs to drug users in the presence of cultural obstacles and political opposition. Overdoses from nonmedical analgesic drugs is the number one cause of drug-induced fatalities and is often the result of gaps in the allocation of social and health resources in urban areas. Furthermore, the harmful effects of drug

abuse are often precipitated or exacerbated by tension-wrought relationships between local law enforcement and drug users, wherein opioid-induced incidents can be rendered fatal when drug users choose not to solicit medical help for fear of arrest or prosecution. The increasing frequency and severity of these incidents is illustrative of the dichotomous nature of federal attitudes towards drug use, which treat legal and illicit activities on a non-incremental scale. Health technologies cannot be directly placed into any community or locale; instead, it is crucial to take the individual and environmental contexts of drug use into account to put effective and equitable health prevention systems into place. To be sure, the intersection of the patient narrative, research in health policy implementation, and the increasing awareness and discourse surrounding the environments in which these policies are being put into place are tenets central to the more egalitarian and effectual use of medical resources.

The state of Pennsylvania has long been struggling to address the issue of overdose control, and until recently, there has been little support from state legislatures to promote the use of lifesaving overdose preventatives like naloxone. Domestically, drug overdose mortality nearly doubled in the United States between 1999 and 2004 (see Appendix One)[2]. Compared with other states, Pennsylvania has notably higher drug overdose deaths, and opioid analgesics are documented as the most commonly abused drugs[3].

Appendix One

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[2] Smith, W.G., E.H. Ellinwood, and G.E. Vaillant. "Narcotic Addicts in the Mid-1960s." *Association of Schools of Public Health* 81 (1966): 403-412. *Jstor*. Web. 26.Mar.2014.

[3] Ball, J.C., & Chambers, C.D. (Eds.) (1970). *The Epidemiology of Opiate Addiction in the United States.* Springfield, IL: Charles C Thomas.

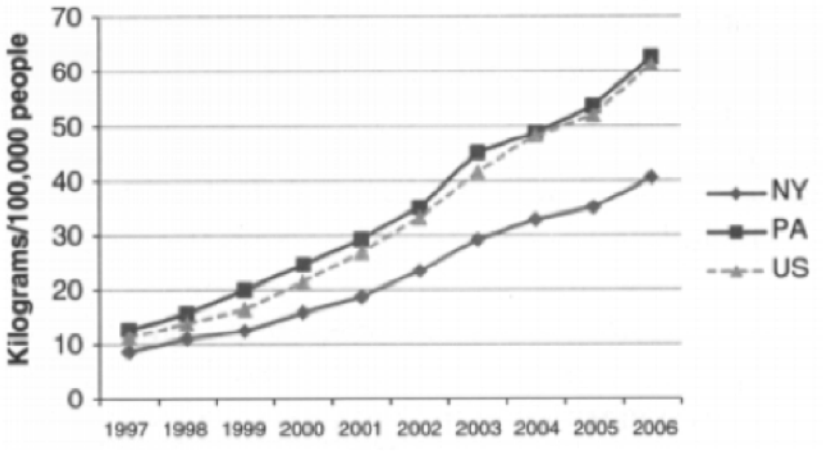

Figure 2: Opioid sales, New York, Pennsylvania, and the United States, 1997–2006.
Note: The Drug Enforcement Administration tracks distribution of selected opioid analgesics and other controlled substances to each state through its Automation of Results and Consolidated Orders System. We converted the grams of opioid analgesic distributed to the two states to kilograms per 100 000 people in morphine equivalents. Note that the methadone data included in these rates do not include methadone used in methadone maintenance programs.

The DEA tracks distribution of selected opioid analgesics in each state; this graph charts the opioid analgesics distributed per 100,000 people between 1997 and 2006.

Source: Smith, W.G., E.H. Ellinwood, and G.E. Vaillant. "Narcotic Addicts in the Mid-1960s." *Association of Schools of Public Health* 81 (1966): 403-412. *Jstor*. Web. 26.Mar.2014.

While opiates have remained easily accessible and widely used in the United States since their medicinal inception in 1845, their incidence and prevalence of use rose to epidemic proportions in the period between 1965 and 1973. Opioid analgesics, a class of pain relievers, were introduced to the American recreational stage in the early 1900s. The drug's appeal was rooted in its physiologically calming effects (as it depresses the central nervous system) and psychologically euphoric effect. The more that a user injects, the greater his tolerance to the drug

and thus the more significant is his need for increased dose sizes [4]. The panic that arose from the drug's incipient abuse on the American cultural stage in the mid-20th century stemmed from a constellation of factors, including a medical concern surrounding the psychological detriments of its use as well as social distress about the drug's capacity to raise rates of crime and deteriorate the moral fabric of American society, a projection of the historically entrenched patterns of economic and racial exclusion that the epidemic brought into relief.

Historically, the stigmatization and inaccessibility of injected opiates through stricter public policies moved drug markets to an illegal underworld, where users were more likely to be ethnic minorities living in unstable economic situations and engaging in risky distribution activities. Injection drug users pushed to the social sidelines were unlikely to seek help because of dominant perceptions of addiction as a mental affliction, a destructor of traditional cultural values, and a cause for larger moral anxiety. These combinations of medical and social misconceptions fostered false constructions of the psychiatric underpinnings of addiction. Insufficient research in the field of addiction and sustainable therapies made doctors and hospitals even less capable of aiding addicts, further aggravating rates of heroin use throughout this period [5].

As drug overdose became more prevalent throughout the mid-20th century, the United States wove stricter control policies through the drug using populations and the greater American moral fabric. Indeed, in 1970, the federal government implemented the Uniform Controlled

[4] National Institute on Drug Abuse. "Drug Facts: Heroin." National Institute on Drug Abuse (NIDA). http://www.drugabuse.gov/publications/drugfacts/heroin (accessed May 10, 2014).

[5] Lula, Chloé. "The American Needle Epidemic: Inadequacies in Social Causations of Injection Drug Use." Epidemic Disease and Public Health. Carnegie Mellon University, 2014. Print.

Substances Act in all states, which established the nation's first drug scheduling system. Given the large number of social, behavioral, and economic differences among local legislatures, however, the impact of state drug laws and bodies to enhance the capacity of regulatory and law enforcement agencies to enforce legitimate medical practices, such as Prescription Drug Monitoring Programs, or PDMPs, on the national epidemic of prescription drug abuse became challenging [6]. Furthermore, many states began passing harsh drug laws of their own during this period, which contributed to the high rates of incarceration that have characterized recent decades. Given the discrepancies inherent in state laws, local governments have had little ability to reach consensus over the best means of overdose control in the last few decades, and the regional variances that shape drug use in each location have not been taken into legislative account. This dire need for implementation research to more efficiently and equitably distribute health resources catalyzed my own decision to study health policy in college, and to study these issues in my independent research.

The Influence of the Urban Environment on Drug Use

Harm reduction approaches have long vied with federal policy strategies, broaching the question of how to best implement outreach programs to drug users in the presence of cultural obstacles and political opposition. Overdoses from nonmedical analgesic drugs is the number one cause of drug-induced fatalities and is often the result of gaps in the allocation of social and health resources in urban areas. Furthermore, the harmful affects of drug abuse are often precipitated or

[6] Paulozzi, Leonard. "Prescription drug laws, drug overdoses, and drug sales in New York and Pennsylvania." *Journal of Public Health Policy* 31 (2010): 422-432. Print.

exacerbated by tension-wrought relationships between local law enforcement and drug users, wherein opioid-induced incidents can be rendered fatal when drug users choose not to solicit medical help for fear of arrest or prosecution [7]. The increasing frequency and severity of these incidents is illustrative of the dichotomous nature of federal attitudes towards drug use, which treat legal and illicit activities on a non-incremental scale. Research performed in the Pittsburgh and New York metropolitan areas demonstrates that opioid analgesic abuse is reinforced by a myriad of interacting socioeconomic factors that have not been addressed or mitigated by federal policies. Because drug distribution networks are so covert and deeply entrenched, it is immediately important to prevent the harmful consequences of drug abuse through local programs that provide educational resources and medical support and to further analyze how interactions between local law enforcement and drug users affects rates of overdose.

Magdalena Cerdá et. al.'s piece "Revisiting the Role of the Urban Environment in Substance Use: The Case of Analgesic Overdose Fatalities" investigates the positive association between "poor" environments and the risk of drug overdose. The study investigates the impacts of the social, built, and economic characteristics of different Manhattan neighborhoods on the prevalence of fatal overdoses attributed to heroin and nonmedical analgesic opiates. The authors found that contextual factors – "social policies and regulations that affect the allocation of social and health resources; social and physical features of the neighborhood environment that structure the availability of drugs, influence norms around use, and generate sources of stress that

[7] Cerdá, Magdalena. "Revisiting the Role of the Urban Environment in Substance Use: The Case of Analgesic Overdose Fatalities." *American Journal of Public Health and the Nations Health* 35.12 (2013): 2252-260. *PubMed*. Web.

contribute to drug use; and interpersonal characteristics, such as social support and social networks that mediate the relationship between the neighborhoods environment and drug use" – shape illicit and nonmedical drug use, and that analgesic abuse is rooted in the belief that prescription drugs are less stigmatizing, less dangerous, and less affected by social consequence than illicit drugs [6]. Ultimately, the study points to the need for research identifying the particular neighborhood mechanisms that may distinguish the risk of analgesic overdose from that of illicit drug overdose, and the necessity for an understanding of nuanced contextual factors influencing localized drug use and resultant social policy.

"Characteristics of an Overdose Prevention, Response, and Naloxone Distribution Program in Pittsburgh and Allegheny County, Pennsylvania" by Alex Bennett et al. describes the process of implementing harm reduction in Pittsburgh and Allegheny County as well as the mechanisms required to institute naloxone distribution programs in drug using neighborhoods. "Community-based overdose prevention programs (OPPs) that equip drug users with skills to identify and respond to an overdose and prescribe naloxone can help users and their peers prevent and reverse potentially fatal overdoses without significant adverse consequences," the authors state [8]. Naloxone, an opioid antagonist used to respond to opioid overdoses, was used by 58% of the organization's participants between 2005 and 2008 and was successful in preventing mortality in 96% of cases. Indeed, the success of the overdose prevention program, coupled with

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[8] Bennett, Alex S., Alice Bell, Laura Tomedi, Eric G. Hulsey, and Alex H. Kral. "Characteristics of an Overdose Prevention, Response, and Naloxone Distribution Program in Pittsburgh and Allegheny County, Pennsylvania." *Journal of Urban Health : Bulletin of the New York Academy of Medicine*. Springer US, 01 Dec. 2011. Web. 13 Apr. 2015.

drug users' reluctance to contact authorities in the case of overdose, indicates the importance of buttressing drug users' knowledge of overdose prevention strategies and providing them with medical options despite having few economic or social resources. Furthermore, the authors elucidate the feasibility of a public policy approach that is non-punitive in nature, cultivating relationships of trust and promoting safer drug using habits.

Though Bennett and Cerdá focus on different urban areas and spheres of drug use, they both demonstrate that successfully implementing technology depends on a deeper understanding of immediate physical and psychosocial environments. In addition to having the resources to more intricately understand the cultural, social, and economic norms that govern areas of drug use, harm reduction programs like Prevention Point are also instrumental in ensuring that users can seek medical attention without the threat of identification, arrest, or prosecution. Furthermore, organizations that fill the spaces between less accessible urban populations and monolithic legal institutions do not impose a strict delineation between use and non-use, thereby guaranteeing that drug users are utilizing best practices and are within reach of medical and social services when they wish to solicit help.

The vein of implementation research in health technologies that these analyses indicate an incipient field that has achieved increasing importance in the realm of public health, investigating how health technologies can be optimized for the specific environments and communities that they serve, and can be scaled up into sustainable programs that can solve health problems for more people. Prevention Point Pittsburgh (PPP) is an organization that champions harm reduction principles, advocating non-coercive, non-judgmental practices rooted

in the knowledge that drug use encompasses a continuum of behaviors and peoples. The organization's main service is syringe exchange, and its overdose prevention model is framed after Bennett et al.'s proposed public health framework [7]. When I visited PPP for my volunteer training, I met with administrators and learned about their policies, procedures, and the resources available to clients. As a group, the volunteers read "One Junky's Odyssey" by I. Thaca, an article that reaffirmed polarizing attitudes prevalent in the medical establishment and thus the need for harm reduction programs to fill the spaces between drug users and doctors [9]. The author, a high-functioning injection drug user living in New York City, describes how her heroin use has always played a functional and beneficial role in her life, primarily as a means of coping with her depression and in giving her energy to work within a challenging professional occupation. In her narrative, she indicates that whether in the hospital or in methadone treatment programs, certain assumptions guided the care that she received and the measures that providers would offer to her. Everywhere she went, her use, and not her withdrawal, was perceived to be her primary problem, and the larger context of her life and drug use was not taken into consideration. "No one hid the fact that they believed [drug users] to be completely dysfunctional, pathetic, and no doubt morally bankrupt," the author posits. "Knowing absolutely nothing about my life or circumstances, every hospital member I dealt with harbored assumptions about who I was and why I was there" [8]. This excerpt points to the problems that programs like Prevention Point have attempted to address by cultivating an anonymous, non-

[9] Thaca, I. "One Junky's Odyssey." *Prevention Point Pittsburgh Newsletter* (2009): 1-13. Web. 15 Nov. 2014.

critical environment that only shepherds users into treatment programs if they seek them out. Certainly, the organization's literature and philosophy elucidates the arbitrary line that delineates licit and illicit drug use, and how public health policy must meet the needs of users within their specific contexts of use. Public health models like Prevention Point should be applied to more locales; healthcare that allows drug users to guide its practices are more sensitive to the needs of their immediate environment, are more effective at implementing health policies relevant to the communities that they serve, and are more successful at quelling the negative individual and social consequences that can arise from drug use.

The New Hepatitis C Treatment Debate

Like those individuals who are most at risk for opiate overdose, groups who contract hepatitis C are typically "unsympathetic victims" from low-resource settings. Furthermore, both overdose prevention (with the increasingly sanctioned use of naloxone) and hepatitis C treatment are new technologies being introduced on the health stage, and which provide the promise for augmented treatment programs. This past year, the FDA approved a pill-a-day treatment for hepatitis C patients, but the drug is so costly that some insurers will only cover it for the sickest patients [10]. The newest medication, Harvoni (approved in October, 2014), can effectively treat hepatitis C in only eight weeks; this is a dramatic improvement from previous treatments like ribavirin and interferon, which must be taken for one year and which do not completely cure the disease. That

[10] Pollack, Andrew. "Hepatitis C Treatment Wins Approval, but Price Relief May Be Limited." The New York Times. December 19, 2014. Accessed February 6, 2015.

Harvoni requires so few pills and thus precipitates a higher rate of patient adherence makes it all the more appealing, and which also contributes to the drug's significant rates of success. Indeed, older treatments took so long to cure patients and had such severe side effects that many patients quit midstream, or did not even start.

The glaring disadvantage with Harvoni, however, is that it costs approximately $1,125 per pill, or $94,500 for a 12-week course of treatment. The expectation, some doctors are speculating, is that with competition with emerging drugs on the market, prices will diminish [11]. Other treatments that are currently available include Sovaldi (approved December 2013), Olysio (approved November 2013), Telaprevir (approved May 2011), Ribavirin (approved in 1998), and Interferon (approved in 1991), though these older drugs do not have nearly as high a success rate as Harvoni does at curing patients [10]. The financial comparison, however, is somewhat complicated because some patients may need only eight weeks of treatment with Harvoni, lowering the average cost for that drug, while others may need up to 24 weeks of treatment.

The combination of high price and high patient volume has led to budgetary problems for health plans, state Medicaid programs, and prison systems (as many inmates are infected with the virus), and some of these institutions are restricting treatment to patients with more advanced liver disease. The corollary, however, is that preventing liver cirrhosis by tackling hepatitis C early in its onset may reduce the need for expensive liver transplants and other costly

[11] Silverman, Ed. "Will The New Hepatitis C Drugs Trigger A Battle Over Cost?" *Forbes*. Forbes Magazine, 11 Nov. 2013. Web. 13 Apr. 2015.

procedures that result from the disease's complications [12]. The current challenge for the healthcare community is to determine how to deliver these treatments at an accessible price bracket for patients in the earliest stages of the disease. Because treatment costs are controlled by monolithic pharmaceutical companies like Gilead, the feasibility of these price changes seems doubtful; the answer consequently lies in health care programs' desire and ability to alter existing delivery systems, and for policymakers to determine how to offer these technologies to the under-resourced populations that need them the most critically.

Business analysts currently estimate that Gilead could charge $80,000 USD for a single course of treatment of sofosbuvir [13]. Nearly 90% of the estimated 185 million people living with hepatitis C worldwide reside in low- and middle-income countries, where government health budgets are small and where most patients have to pay for medicines out of pocket (which means that new hepatitis C medications will remain out of reach for the majority of those in need). Indeed, the greatest burden of hepatitis C falls on middle-income countries: the World Health Organization has termed hepatitis C the "viral time bomb" because most people living with hepatitis C are unaware of their status and can remain without symptoms for decades [14]. More than 350,000 people die annually from hepatitis C-related liver diseases, primarily in middle-income countries, or "emerging markets," as coined by the pharmaceutical industry, in

[12] Canadian Agency for Drugs and Technologies in Health. "Holkira (Ombitasvir/Paritaprevir/ Ritonavir with Dasabuvir) and Harvoni (Ledipasvir/Sofosbuvir) for Chronic Hepatitis C: A Review of the Clinical Evidence." U.S. National Library of Medicine, 01 Jan. 2015. Web. 13 Apr. 2015.

[13] Open Society Justice Initiative. "Beyond the Hype: What Subsovir Means - and Doesn't - for Global Hepatitis C Treatment." *Open Society Justice Initiative* (n.d.): n. pag. *Open Society Foundation*. Open Society Foundation, 1 Jan. 2015. Web. 14 Apr. 2015.

[14] WHO (2002). Coverage of selected health services for HIV/AIDS prevention and care in less developed countries in 2001. Retrieved from: http://bit.ly/11cxb4y.

anticipation of increasing numbers of citizens and governments purchasing brand-name medicines over time. The companies producing new HCV drugs frequently target wealthy elites and their physicians rather than seeking to increase sales to the population as a whole, a phenomenon that tightly parallels the populations of poor people in the United States with limited access to overdose prevention care and general health resources [15].

The simplest solution, then, would be for more manufacturers of the new hepatitis C medicines to lower their prices to levels affordable for governments operating with limited health budgets in low- and middle-income countries (indeed, treatment advocates worldwide, including the humanitarian aid organization and MSF are suggesting a price of less than $500 USD) [16]. Past experiences with HIV, however, indicate that drug companies are unlikely to extend significant discounts to middle-income countries, even if they may be open to reducing the price for the world's poorest (see Appendix Two). The entry of generic HIV medication competitors drove massive price reductions, which lowered the price of antiretroviral treatment from $10,000 USD to under $100 USD per patient, per year. This competition, as well as the community activism that challenged a system where treatment was only for the rich, enabled the tremendous scale-up of treatment in low-and middle-income countries. Before the entry of generic medicines, only 50,000 people living with HIV in limited resource settings were receiving HIV

[15] Momenghalibaf, A (2013). "Hepatitis C Treatment: Price, Profits, and Barriers to Access." New York, Open Society Foundations. Retrieved from: http://osf.to/1c9huQZ.

[16] Médecins Sans Frontières Access Campaign. (July 2013). Untangling the web of antiretroviral price reductions. Retrieved from: http://bit.ly/1gjjpmP.

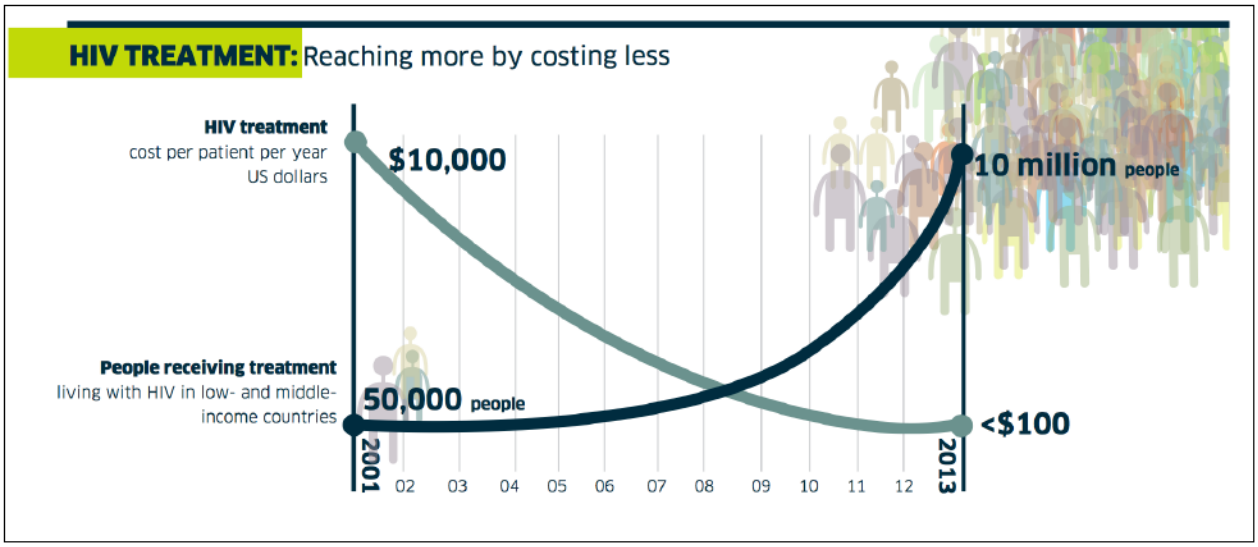
treatment. Today, nearly 10 million do [17]. This HIV example is instructive for how the availability of hepatitis C medications may also be expanded.

The corollary question, then, is whether citizens, government officials, and international bodies (like the World Health Organization) are committed to push for affordable prices, as price reduction remains the key to ensuring scale up. Civil society organizations in other countries have advocated successfully for lower treatment prices and greater government commitments. In the Ukraine, for example, public organizations like the International HIV/AIDS Alliance have reached an agreement with the Global Fund to Fight AIDS, Tuberculosis, and Malaria to fund treatment for people who inject drugs (to be delivered alongside opioid substitution therapy and HIV treatments) [18]. The price of these treatments has been halved during negotiations with pharmaceutical companies and the government has adopted a national viral hepatitis program – a paradigm shift that could be utilized as a model in countries with similar social, political, and economic incentives to help comparable health initiatives.

Appendix Two

[17] UNAIDS (June 2013). Global update on HIV treatment 2013: Results, impact and opportunities. Retrieved from: http://bit.ly/lqhqSr.

[18] The Global Commission on Drug Policy (May 2013). The Negative Impact of the War on Drugs on Public Health: The Hidden Hepatitis C Epidemic. Retrieved from: http://osf.to/1cwCrna.



In the case of access to HIV medicines, it was the entry of generic competitors into the market that drove massive price reductions.

Source: Open Society Justice Initiative. "Beyond the Hype: What Subsovir Means - and Doesn't - for Global Hepatitis C Treatment." *Open Society Justice Initiative* (n.d.): n. pag. *Open Society Foundation*. Open Society Foundation, 1 Jan. 2015. Web. 14 Apr. 2015.

Conclusion

My first investigations into America's history of drug abuse and healthcare initiatives have led me to conclude that limitations in legal enforcement and discrepancies in the institutions involved in monitoring health problems (including state bureaucracies, hospitals, and humanitarian organizations) can result in inconsistent policy formation and policy execution, which makes medical practices in different countries difficult to uniformly oversee. As medical research has accelerated in the latter half of the twentieth century and produced more medical therapies, health care research and infrastructures have become increasingly widespread and more difficult to monitor or control. The upshot of these developments – a richer body of

scientific knowledge and greater arsenal of tools with which to treat human health – has been coupled with a fundamental inequity in the persons able to access these benefits. People culturally stigmatized or financially disenfranchised fall under the radar of governing health bodies, giving them little advocacy on behalf their own health. Humanitarian organizations supervising these problems are often associated with different administrative umbrellas, failing to fill address significant gaps in developing health care structures.

Insufficiencies in individual autonomy, consent, and nondiscrimination within government health provisions vie with human rights and the privileges inherent in democratic citizenship. In the latter twentieth century, rapid influxes in biomedical innovations created a paradox in which more medical successes yielded higher expectations for what medicine should achieve, and this greater investment in research has produced more expensive treatments and health care solutions difficult to implement. Despite government efforts to create institutions capable of equitably allocating these resources, there remain populations inherently alienated or inaccessible that will not have advocacy for their own attainment of medical interventions and biological rights, creating an ironic parallel between people in under-resourced countries and communities in under-resourced social and geographical spaces in the richest country in the world, both incapable of receiving the care they need. The ethnographers and historians that I have studied have underscored these gaps in patient rights and have insinuated that the ethical relativism that justifies such crises demands better nongovernmental organizational support to prevent breakdowns in consent processes and to protect social welfare systems. Their examinations of these cases in bioethics have also addressed the degree to which public health

care institutions should be accountable for patient rights and which larger groups of people should be held responsible for the protection of these directives. The authors' collected observations have pointed to an obligation to fill the social space that has appeared between countries' public health organizations and socioeconomically vulnerable people. Health services should be categorized according to priority for the worse off, expansion of coverage for high-priority services, and an assurance that the disadvantaged will not be left behind in health care programs (and that their voices can be heard in directing the treatment that they receive). Though initiatives with these aims in mind have become more widespread in recent decades, their continued implementation will become increasingly important with the growth of biomedical tools and their coexisting humanitarian uncertainties.

Over the course of my internship in Geneva last summer and throughout this past year in my thesis research, I have examined systematic reviews of different strategies for the dissemination and implementation of research findings to identify evidence of their effectiveness, and have sought to answer the question of how to fund high-quality, sustainable research and development (R&D) in regions when the people who need these technologies do not possess the means to pay for them and how policymakers can create R&D solutions that improve the equity, efficiency, adaptability, and inclusiveness of healthcare infrastructures using financial and technological resources that already exist. These readings and my internship experience exposed me to the importance of bolstering collaboration between public health decision-makers as well as the socio-economic factors that are necessary to take into account before scaling up cost-effective health measures.

High-level policies initially gave rise to public health institutions, which have traditionally endorsed punitive approaches to drug users and thus have been unable to adequately help at-risk populations, and specifically, those at risk of opiate overdose and hepatitis C contraction. These deficiencies influenced the rise of NGOs like Prevention Point Pittsburgh that have adopted incremental drug policy approaches that aim to better identify populations at risk, and to mitigate the cultural and larger contextual obstacles that hinder technological implementation. This harm reduction organization's persistence in offering needle exchange services has created ongoing action while simultaneously working on the policy side; just the advocacy without action would not have been as effective, and would have meant years of delay in getting needle exchange services to people who need them. Whether or not technologies such as those that PPP are providing are accessible (and affordable, as in the case of Harvoni) determines whether or not they will feasibly reach at-risk populations; the availability of these interventions is decided by political willingness to allocate resources towards these technologies, which is in turn decided by our country's high-level policies.

Hepatitis C and overdose prevention are both cases that exemplify this cause and effect, and that can be studied in urban areas like Pittsburgh, which acts as a "laboratory of innovation" for implementation research. While hepatitis C offers a treatment that is actually new, overdose offers new uses for an existing drug, naloxone, in wake of evolving laws in Pennsylvania that decide who can own and use the drug. Both of these case studies disproportionately affect marginalized groups that lack financial resources, and it seems as if the key to ensuring equitable access lies in demanding action from governments, in re-allocating resources, in encouraging

financial transparency and development incentives with pharmaceutical companies, and in scaling up harm reduction measures like those currently in place in Pittsburgh. At a local level – and more directly within the scope of my thesis – greater attention needs to be given to actively coordinating dissemination and implementation to ensure that research findings are implemented; local policymakers with responsibility for professional education or quality assurance need to be aware of the results of implementation research; and greater emphasis should be given to conducting studies that evaluate two or more interventions in a specific setting or to help clarify the circumstances that are likely to modify the effectiveness of an intervention.

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