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THE KNOCKDOWN OF RAB8 AND RAB11 PROTEINS ON THE TRAFFICKING OF DENGUE VIRUS AND THE PHILOSOPHICAL IMPLICATIONS ON PUBLIC HEALTH

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THE KNOCKDOWN OF RAB8 AND RAB11 PROTEINS ON THE TRAFFICKING OF DENGUE VIRUS AND THE PHILOSOPHICAL IMPLICATIONS ON PUBLIC HEALTH

A thesis submitted to
Regis College
The Honors Program
in partial fulfillment of the requirements
for Graduation with Honors

by

Maddie Labor

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Preface

I have spent four years in a classroom with professors and peers who have challenged my ideas, strengthened my arguments, and supported my opinions. I have learned how to analyze literature, discuss philosophical concepts, how to manipulate equations to solve for the unknown, and how to think independently. I have so much appreciation for my Jesuit education; in addition to the above I have learned how to think critically, developed my strengths as a leader, deepened my passion for learning, increased my global understanding and commitment to justice, as well as been able to develop myself as a whole person.

Reflecting on all of these benefits, I wanted to find a way to integrate my four years into my thesis. I knew that I was going to write about my undergraduate research with one of my professors on Dengue virus, but this almost seemed too simple for a thesis. I look upon my thesis as a culmination of my undergraduate education; what did I get out of eight semesters? Did I become a force to be reckoned with? Is my education backed, does it have multiple layers? What did I do, learn, accomplish in 200+ credit hours?

After this reflection, I found myself in a deeper hole than I started out with; instead of trying to figure out *one* concept I was interested in writing a 60-page thesis on, I now had 20 different ideas circulating in my head. Months of sifting went by, until I came upon the final decision of incorporating philosophy into my discussion of public health. I felt as if this was the perfect combination of everything that I have learned while at Regis. My research was able to demonstrate my ability to think critically, work collaboratively and show my devotion to learning new procedures as well as seeking to find an answer to a scientific problem.

Incorporating public health ethics demonstrates my ability to increase my global understanding of health care in different cultures and countries, and using political philosophy as my medium for discussion showed my commitment to justice.

While writing my thesis over the course of the fall semester, I have also been starting my application process for medical school. I have been reflecting on the reasons why I want to go to medical school, and consequently why I want to become a physician. I know that I want to help people, but there are many disciplines that I could go into if this was my main goal; social work, psychologist/therapist, or even go into work for a non-profit. Through the many different literary works that I have encountered within the curriculum at Regis, and especially within the Honors Program, I have come to understand why I want to help people specifically as a physician.

Being a great doctor requires technical knowledge, emotional intelligence, and communication skills. While many doctors have the required technical knowledge, I think that becoming a doctor is my calling because I see the importance of the other parts of the job as well. Additionally, the work of a doctor speaks to me in ways that other professions do not because I have a personal connection with chronic illness and how it is treated, as I explain below. Medicine is an interdisciplinary field of science and human interaction, just like my education at Regis. While the body is the medium that we must protect and preserve, the mind is just as important. Even though we can cure disease and stitch up gashes, human life is frail, and we cannot escape death. When science fails us, we need to understand how to help those affected navigate their life. More often than not, medicine cannot save a person's life, and therefore we must understand how to communicate thoughtfully and respectfully to the family and individual. This is a skill that not many physicians have, and it is one of the biggest reasons why I want to

become a doctor. I believe that I can handle the professional rigors of medicine, but I can also

offer the connection and support to families and patients in times of disease or death.

Personally, my family has been in the middle of many different diagnoses. My mom was

diagnosed with breast cancer when I was a Junior in high school, and both my siblings struggle

with chronic health issues. I have seen how much patient-doctor interactions matter in times of

disease, as well as how much it benefits not only the patient, but also the family when doctors are

able to connect with and walk an individual through treatment. I am passionate about being the

type of healthcare provider that patients can look to for both advice and emotional support during

their hardest times. This holistic view of medicine is how I hope to change the face of health

care. I am not striving for global or national reform, but rather community reform. Therefore,

changing the face of medicine might not be finding a new drug or lifesaving surgery, but instead

improving the relationships that people have with practitioners.

I chose to discuss philosophy in regards to public health because of the newfound love I

developed for it at Regis. I had a professor that really sparked my interest for it, and since

minoring in it would prove to be too difficult with my schedule, I decided to instead construct

my thesis with it. I chose the book *Inclusion and Democracy* by Iris Young to discuss public

health and the political sphere. Iris Young was a political theorist who focused on the nature of

justice and social difference. I thought her work would best exemplify the theory behind public

health, as I believe that access to public health is a universal human right.

In one of her first chapters in *Inclusion and Democracy*, she writes: "reasonable people

often have crazy ideas; what makes them reasonable is their willingness to listen to others who

want to explain to them why their ideas are incorrect or inappropriate" (24). Through the

discussion of public health and philosophy within my thesis, I am hoping to start a bigger discussion around what philosophy and political inclusion can do for us in health care reform as well as access in the United States as well as across the world.

Overall, my thesis shows my ability to pull from various disciplines in order to create new trajectories of discussion. It also shows what I hope to be as a doctor in the future; someone who is able to make medical and scientific decisions as well as treat a person as a whole. My Jesuit education has allowed this reflection, and I wanted to show this in what I consider to be the final stamp on my previous four years of undergrad.

<u>INTRODUCTION</u>

Dengue (DENV) is an old vector-borne disease that became spread worldwide in the tropics during the 18th and 19th century, a time when sea trade was expanding (Gubler 2002). The mosquito vector of Dengue is *Aedes aegypti*. The virus spread successfully by these sailing ships because the stored water on board was an excellent breeding site for mosquitoes and could maintain the transmission cycle of the virus. There are four Dengue serotypes, DEN-1,2,3 and 4, and the virus belongs to the genus Flavivirus and family *Flaviviridae*, and the genome is a single-stranded, positive-sense RNA. While the epidemiology of the four serotypes are the same, they are genetically unique (Chen and Vasilakis, 2011). Dengue primarily infects cells of the myeloid lineage (macrophages, monocytes, and dendritic cells) (WHO 2018). It is a severe flu-like illness that can sometimes cause a lethal complication called severe Dengue, or Dengue Hemorrhagic Fever (DHF) (WHO.int). Severe dengue involves plasma leakage, severe bleeding, fluid accumulation, and organ impairment (WHO.int).

The global epidemiology[1] was changed in Southeast Asia during World War II due to rapid urbanization (Gubler et al. 2002). Each of the four DENV serotypes are maintained in two transmission cycles: a sylvatic cycle and a human cycle (Vasilakis et al. 2011).

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[1] Per the CDC, epidemiology is the study of the distribution and determinants of health-related states and events in specified populations. Global epidemiology, which I reference above, addresses the causes and consequences of morbidity and mortality that cross regional and national boundaries. After WWII, there was a substantial increase in the geographic distribution of all four DENV serotypes which was fueled by uncontrolled urbanization, rapid population movement from jet travel, inadequate water, sewer and waste management, and unsustainable vector control programs (Gubler et al. 1997).
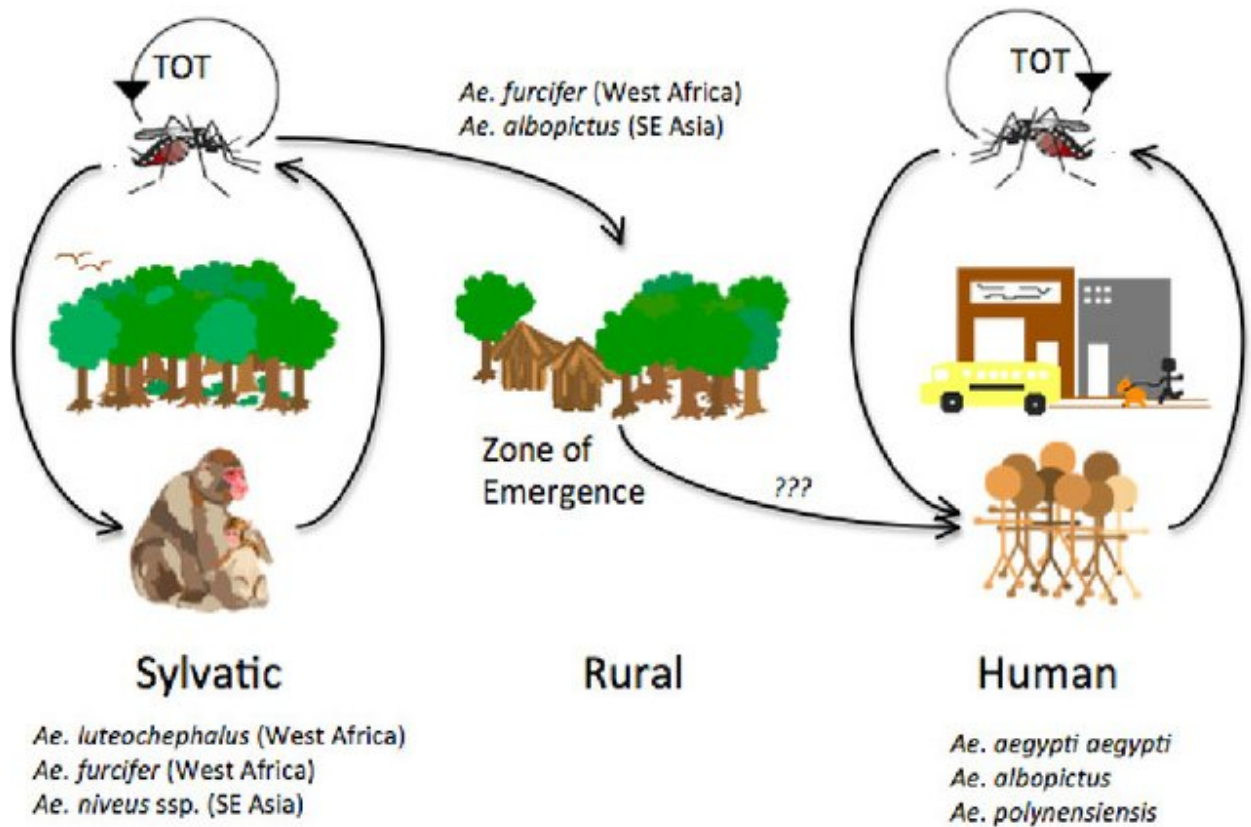
Figure 1. Transmission cycles of Dengue (DENV) showing the sylvatic origins and the "zone of emergence" where the sylvatic cycles contact human populations in rural areas in West Africa and Southeast Asia. Transovarial transmission (TOT) has been suggested as a mechanism of DENV maintenance in both cycles (adapted from Chen and Vasilakis, 2011)

The sylvatic cycle involves the *Aedes* mosquitos and the non-human primates. In the human cycle, which involves *Aedes aegypti* and *Aedes albopictus*, humans are the only known reservoir hosts and amplification hosts (Chen and Vasilakis, 2011). It is difficult to discern where and when the emergence of DENV infection occurred in humans, but Dengue was first documented in the Americas at the end of the eighteenth century, and its arrival is likely to have been a result of the slave trade (Vasilakis et al. 2011). The disturbance of the ecology caused by

the war helped to expand dengue's geographical reach and increased the density of the mosquito, while the movement of the troops increased the spread of the virus as well (Gubler et al. 2002).

Modern transportation has facilitated an increased movement of people and goods around the world, which has caused an increase in the movement of both the mosquito and virus (Gruber 2002). The virus thrives in poor urban areas, suburbs, and the countryside, but can also affect more affluent areas in tropical and subtropical countries (WHO.int). The global distribution of dengue is similar to that of malaria, with an estimated 3.9 billion people who are living in areas that are at risk for epidemic transmission (WHO.int), and more current reports put almost half of the world's population at risk (WHO.int). Currently, an estimated 390 million infections occur each year, but this number could be higher due to the inadequate surveillance of the disease in poor and underserved countries and because 75% of Dengue infections are mild or asymptomatic (WHO 2018).

The last 50 years have seen an unexpected rise in the incidence of Dengue and the increase in the magnitude and frequency of outbreaks (WHO 2018). The increase in the transmission is strongly influenced by population density and ecological factors that are increasing due to global warming (temperature, rainfall, and altitude) (WHO 2018).

Many solutions are discussed in the current literature. One involves restarting the program in the Americas that eradicated the mosquito vector responsible for Yellow Fever. This program was highly successful; however, once the program dissolved in the 1970s, the mosquitos re-invaded (Gubler et al. 2002). New medical infrastructure needs to be created in developing countries, as the overloading of clinics and hospitals by patients with Dengue fever or with mild non-Dengue virus overwork the medical staff. This strain on medical professionals

leads to substandard care for patients with threatening severe Dengue and can, therefore, increase

mortality (Gubler et al. 2002).

Because of the increasing prevalence of dengue worldwide, it is important to start finding

solutions and possible treatments of the disease. Kobayashi and colleagues have shown that Rab8

proteins are upregulated in West Nile Virus, which is similar to dengue (single-stranded,

positive-sense RNA virus). The Rab protein family regulate intracellular membrane traffic, and

are involved in the life cycles of various enveloped viruses, like Dengue (Kobayashi et al. 2016).

Kobayashi and colleagues found that Rab8 is essential for WNV release and defective Rab8

results in the accumulation of WNV particles in the recycling endosomes. Based on this study, I

am going to investigate Rab8 and Rab11 proteins and their importance in the Dengue life cycle,

especially in the release of the virus itself.

MATERIALS AND METHODS

Cell lines.

Vero-E6 cells were used for all experiments.

Virus stocks and titration.

DV serotype 2 strain NGC was propagated in LLCMK-2 cells cultured in DMEM media

(Gibco) supplemented with 5% heat inactivated FBS (Atlas Biologicals). Virus titer was

determined by Tissue Culture infectious dose 50 (TCID50) on Vero E6 cells using standard

methods.

Infections.

Infections were done in 6-well dishes. Working two wells at a time, PBS was removed from the Rab well and the negative control (NC) well and replaced with 1 ml of virus dilution (Infection media and DV2 NGC 1:10 dilution). Only infection media was introduced into the mock wells. Plates were placed in the incubator for one hour with intermittent rocking. After one hour, the virus and infection media were removed from the wells and was replaced with complete growth media (containing serum) and were placed back in the incubator. Supernatants were removed at 24 and 48 hours post infection and stored at -20°C for TCID50. Cell lysates were collected in Lamelli buffer and stored for western blotting

Immunofluorescence.

Cells were fixated with 4% formaldehyde and was then incubated at 4 degrees Celsius for storage. To permeabilize the cells, 20% Triton X-100 was diluted to make a 0.2% solution (1:100 dilution). The formaldehyde was replaced with 0.2% Triton X-100 and incubated. Primary antibody supplemented serum was added and allowed to bind. Following binding, the cells were washed with PBS-Tween. The PBS-Tween was then replaced with the secondary antibody diluted 1:1000 in PBS-Tween with 10% serum. Once incubated, the cells were washed with PBS-Tween as before. The cells were then counterstained and mounted and then analyzed under a fluorescent microscope.

Transfection of siRNAs.

siRNAs for Rab8 and Rab11 were purchased from Dharmacon. siRNAs were diluted in Opti-MEM media at an empirically determined concentration. Dharmacon's Dharmafect reagent was additionally diluted in Opti-MEM; reagent and siRNAs were incubated at room temperature for 5 minutes. siRNAs and Dharmafect were then combined and allowed to form transfection complexes by incubation at room temperature for 20 minutes. After incubation,,

siRNA/Dharmafect complexes were added directly to cells to complete DMEM and incubated

for the indicated times prior to western blotting. For transfection/infection experiments, cells

were transfected for 24 or 48 hours prior to infecting with DV-2 as described above.

Western Blotting.

Cell lysates were harvested in a cell lysis buffer (Cell Signaling) in the presence of

protease and phosphatase inhibitors (HALT inhibitor, Peirce) followed by 3X freeze-thaw

cycles. Lysates were then diluted in Lamelli sample buffer (Cell Signaling) and separated by

SDS-PAGE. Proteins were transferred to nitrocellulose membranes, blocked for 1 hour in 5%

nonfat dry milk, and probed for Rab or actin proteins. Antibodies directed against Rabs were used

at a 1:2000 dilution and incubated for a minimum of 3 hours. Anti-Actin antibodies were used at a 1:1000

dilution Membranes were washed 3X in PBS-Tween 20, then HRP-conjugated secondary antibodies were

added in 5% NFDM at a dilution of 1:10,000 for 30 to 60 minutes. Membranes were washed 3X and

metal-enhanced DAB reagent was added. HRP will cleave DAB, leaving a brown spot on the membrane

where antibody-bound proteins are present. Densitometry of bands was performed using NIH ImageJ

software and reported as Rab band intensity relative to Actin band intensity.

TCID-50.

This procedure is performed to determine the infectious titer of any virus which can cause

cytopathic effects (CPE), and to quantify how much infectious virus is in a preparation. Virus-

containing culture supernatants were serially diluted 1:2 in infectious media, then placed onto Vero E6

cells and incubated for 24 hours. Cells were then fixed for 20 minutes in 4% formaldehyde followed by

permeabilization with 0.2% Triton-X 100 for 5 minutes. To determine the presence of virus, cells were

incubated with anti-DV2 antibody for 90 minutes, washed 3X with PBS-Tween 20, and incubate with a

goat-anti-mouse HRP conjugated secondary antibody for 30 minutes. Cells were then washed 3X with

PBS-Tween 20 and incubated with TMB substrate. After approximately 5 minutes, wells where TMB had

been cleaved by HRP appeared blue and were marked as positive for DV infection. TCID50 was

calculated using the Reed-Muench TCID50 calculator

RESULTS

KNOCKDOWN OF RAB PROTEINS

Previous experiments with West Nile Virus (Kobayashi et al. 2016) showed that Rab8 is

essential for WNV release and defective Rab8 results in the accumulation of WNV particles in

the recycling endosome. We wanted to determine if the same was true for the closely related

Dengue virus.

To investigate, we first used siRNAs to knockdown the expression of Rab8 and Rab11

proteins in Vero E6 cells. Cells were transfected with siRNAs directed at Rab8 or Rab11 at a

concentration of 25 nM, or where mock transfected with reagent only. Cell lysates were

harvested at 24 and 48 hpt and western blots performed to determine knockdown efficiency.

Actin was used as a loading control, and levels of Rab proteins were measured and expressed

relative to actin levels (Figure 1).

Through the use of siRNA, we were able to successfully silence the genes responsible for

the production of both Rab8 and Rab 11 proteins (Figure 1). At 24 hours there was a 8% efficacy

of knockdown and by 48 hours post transfection there was about a 15% efficacy of protein

knockdown. While this is a small decrease in protein expression, we nevertheless tested whether

this amount of knockdown was sufficient to alter Dengue virus replication and release.
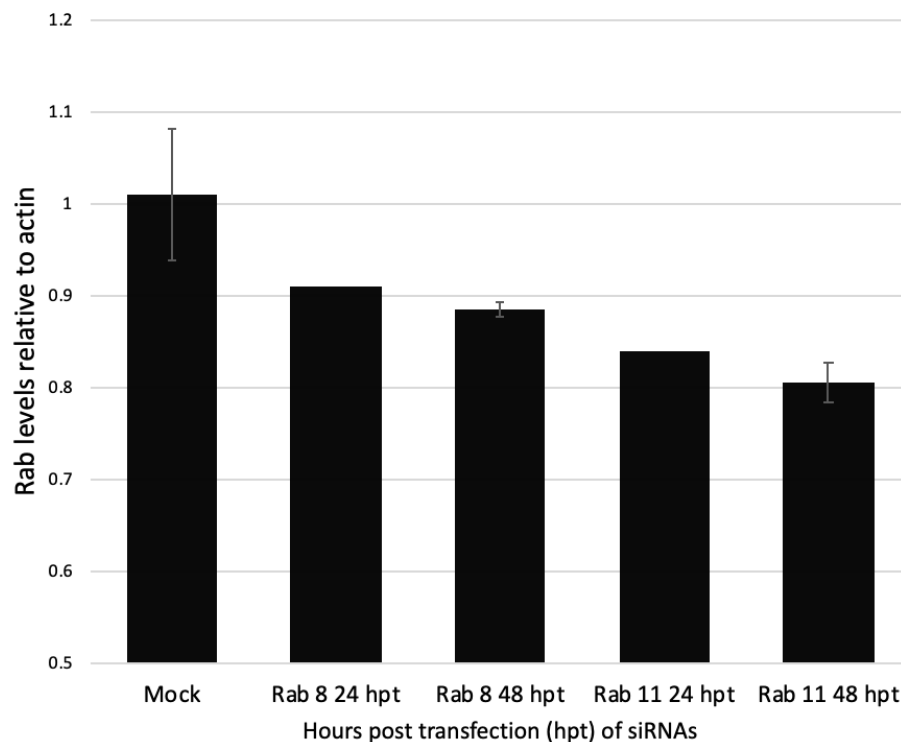
Figure 1. siRNA knockdown of Rab8 and Rab11 proteins, 24- and 48-hours post transfection. Mock as control. Error bars represent standard deviation.

RAB KNOCKDOWN DECREASES DENGUE VIRUS RELEASE

Rab proteins are involved in the movement of cellular proteins through the ER and Golgi. As Dengue virus moves through the cellular compartments during its replication and release, it is possible that these proteins are involved in Dengue movement, as they are for West Nile Virus.

After our transfection, we then infected both our Rab8 and Rab11 knockdown cells with DENV. After infection, we then determined the infectious titer via cytopathic effects and quantified how much infectious virus was in our preparation. Via TCID50, we found a decrease in the amount of virus released in both of our knockdowns.

While the amount knocked down was not substantial, it was enough to inhibit the virus protein production (Figure 2). There was around an 80% decrease in viral release in both the Rab8 and Rab11 knockdown cells. There was no difference in viral release in 24 or 48 hpi. These findings suggest that both Rab8 and Rab11 are important in the life cycle of Dengue, especially in its release, since such a small amount of protein knockdown caused a significant decrease in viral release.

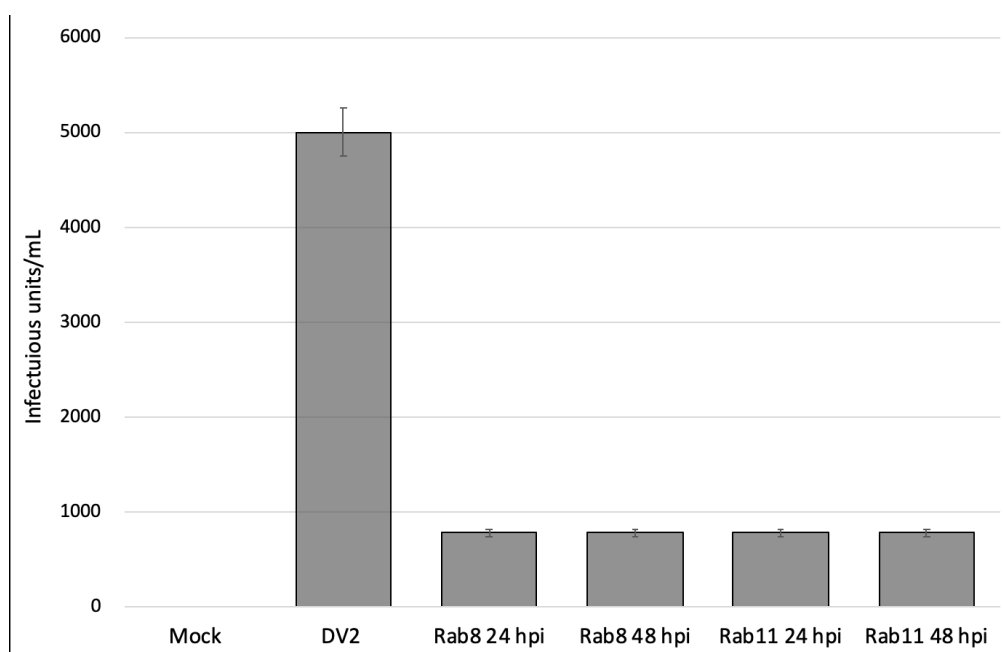**Figure 2.** TCID-50 viral yield after Rab8 and Rab11 knockdown, 24- and 48-hours post infection. Error bars represent standard deviation.

DISCUSSION

Through our knockdown of Rab8 and Rab11 proteins and the subsequent loss of viral release, we can conclude that their function is important for Dengue viral release. Through our study, we were able to knockdown Rab8 and Rab11 proteins via siRNA by 15% which then

contributed to an 80% decrease in viral release once infected with Dengue. We believe that Rab proteins are extremely important in the viral life cycle of DENV, especially in the release mechanism of the virus.

These findings may also be applicable to other Flaviviruses such as Yellow Fever and Japanese Encephalitis. Rab proteins may also be integral to viruses outside of the Flaviviridae family that rely on the Endoplasmic Reticulum and Golgi for part of their replication cycle (such as Influenza).

Knowing the role of Rab proteins can be of extreme significance in the future. The continual study of their mechanism in viral infection can help us to develop antiviral drugs that prevent Rabs from binding to vesicles that contain viruses. However, future studies will need to determine what the function of Rab proteins are in normal cellular life cycles so that the knockdown of these proteins do not create adverse effects.

We were hoping to measure other things, such as what differences were occurring within the cell and its organelles. One study we were hoping to carry out was to see where the virus was being backloaded in the cell, such as the Endoplasmic Reticulum. If we were to have seen an accumulation in the ER, then this finding would signify that Rab proteins are the main transporter protein from the ER to the budding of the virus at the cell membrane. Another study could investigate if there is less viral proteins in the cells with the Rabs knocked down, which would indicate that these proteins may be used for another part of the viral cycle not related to egress.

While it would have been favorable to continue this study, our research was cut short due to the coronavirus Stay-At-Home orders. However, we have a good basis of understanding about

the importance of these proteins to where a new laboratory student would be able to take over the

research and finish it themselves in the future.

PHILOSOPHICAL AND ETHICAL DISCUSSION

Chapter 1: Why Talk About Ethics in Public Health?

Ethics is a division of philosophy that is interested in moral questions and attempts to figure out how human beings should act. As we know from experience, these questions are hard to answer. From my liberal arts, Jesuit education, I have found that these questions often never have an easy answer, and some may never even have an answer at all. The goal of my thesis is not to change American healthcare, but rather to open up discussion on how we can better improve it. Small steps may lead to large strides. One of my favorite quotes from Iris Young's political piece, *Inclusion and Democracy*, is "reasonable people often have crazy ideas; what makes them reasonable is their willingness to listen to others…" (24). While some people may not agree with my stance on public health, I welcome their reasonings and explanations, as the democratic process of discussion is my main goal. I believe that through democratic discussion, and inclusion we will be able to create a health care system that works for every socioeconomic background.

A subfield of ethics called "Practical Ethics" considers moral principles in the context of specific circumstances, rather than in general terms. Public health is therefore a branch of practical ethics, as all public health decisions have ethical implications (Carter et al. 2012). Public health has changed over the decades as public health needs have evolved. The U.S. Public Health Service credits John Adams with originating national public health policy in 1798, where he established the Act for the Relief of Sick and Disabled Seamen. The evolution of public health continues throughout the 19th century as military hospitals were established in cities, which formed a foundation for the national public health system (USC.edu). After a series of

global infectious epidemics at the end of the 19th century (smallpox, cholera, yellow fever, etc.), there were great efforts to improve immunization standards, which shifted the focus of public health policy from the military to the general population which was driven by the need to stop infectious diseases from taking hold in the US (USC.edu). The World Health Organization states, "the global public health landscape has changed dramatically since WHO was established in 1948" (WHO.int). The founding of WHO was itself an important step in the evolution of public health.[2]

All societies face the realities of both disease and death, and must develop concepts and methods to manage them. Methods that have been developed have stemmed from scientific trial and error, but also have strong ties to cultural and societal conditions as well as beliefs and practices (Tulchinsky et al. 2014).

The evolution of public health is a history of the search for adequate means of securing health and preventing disease within a population. With epidemics of infectious disease blotting our history, as well as its continued prevalence (for example, the Dengue virus), figuring out how to prevent disease before an outbreak became increasingly important. Prevention has then begun to revolve around defining the disease, measuring its prevalence, and then seeking effective interventions (Tulchinsky et al. 2014).

Public health has matured through both trial and error and the expansion of scientific medical knowledge, and was often stimulated through devastating events such as war and natural disaster (Tulchinsky et al. 2014). This need for an organized health protection grew as

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[2] In the years following the turn of the 20th century, climate change is creating new public health challenges. While this is one of the most important challenges to modern public health, I will only briefly discuss it here.

communities developed through processes like urbanization. The attempt to control communicable disease involved sanitation, town planning, and the arrangement of medical care (Tulchinsky et al. 2014). However, public health is sometimes seen as a threat to religious and social practices, and these practices can impede its progress. For example, birth control, immunization, and food fortification have all been opposed because they seem to threaten religious ideologies (Tulchinsky et al. 2014).

Today, we still face the battle with communicable diseases. However, due to our increased lifespan we now have to fight against other modern pandemics such as cardiovascular disease, cancers, mental illness and trauma. We have to also deal with the emergence of diseases such as AIDS, SARS, and drug resistant microorganisms. We are also facing severe climate and ecological change, which can pose very harsh and devastating consequences for society (Tulchinsky et al. 2014).

Therefore, public health is an ever-evolving process; pathogens change, as well as the environment and the host. For us to adequately be ready for the challenges ahead, we must understand the past. Therefore, public health ethics can be a helpful lens through which to look at how we can improve the health of others, and maybe even prevent disease.

What has been constant in public health evolution is that there should be a sense of general public interest and a desire to improve the health of an entire population. One paper describes public health as "collective action for sustained population-wide health improvement" (Beaglehole et al. 2004). I appreciated this definition as it gives us the hallmarks of public health practice: the focus on collective action as well as the goal of health improvement.

Ethically, to tackle the major global health challenges effectively, the practice of public health needs to change. While focusing on urgent health priorities is imperative (such as tackling HIV/AIDS, tuberculosis, and malaria), programs and policies are needed to respond to poverty (the basic cause of much of global burden of disease), non-communicable disease, and to address environmental change (Beaglehole et al. 2004).

Global health challenges require a workforce that is able to work across disciplines and sectors, as well as have the skills to influence policy-making at the local, national and global levels. Beaglehole and colleagues explain that public-health practitioners should be closely connected with the communities that they serve to build the long-term support and sustainability needed to respond to global challenges (Beaglehole et al. 2004).

What is the difference between public health and medicine? Medicine focuses solely on the treatment and recovery of patients, whereas public health aims to understand the causes of disease in a population. In medicine, the interaction is solely between the physician and patient, whereas public health involves collaboration and relationships among many professionals, members of the community, as well as the government (Weed, 1999). Hence, public health requires the study of systemic issues (including a community's laws, practices, and activities), whereas medicine is the treatment of particular issues.

Modern public health has five key characteristics that are imperative to its success: health systems leadership, collaborative actions, multidisciplinary approach, political engagement in public health policy, and community partnerships (Beaglehole et al. 2004).

"Health systems leadership" helps to define strategic directions for health systems, which is a central public . This requires a long-term perspective and involves several specific activities

(Beaglehole et al. 2004). An example of health systems leadership is the eradication of Polio,

via the Global Polio Eradication Initiative (GPEI), which has reduced the prevalence of Polio by

99% (WHO.int). GEPI is a public-private partnership that is led by five international partners

including WHO, Rotary International, CDC, UNICEF, Bill and Melinda Gates Foundation, and

Gavi (PolioEradication.gov). The initiative began in 1988 and still continues today. Steps to

eradicate the disease included vaccinating children, organizing "national immunization days",

expanding environmental prevalence in communities, and organizing targeted campaigns to

vaccinate once the virus is localized into a certain area (PolioEradication.gov). This has

obviously been very effective in decreasing the prevalence of polio, and efforts are still going on

today to completely eradicate the disease from the three countries where it is still found:

Afghanistan, Pakistan, Nigeria, and Syria (due to the collapsed infrastructure from the civil war).

The second key to the success of a public health system is "Collaborative actions," which

involve partnerships with a wide range of groups from many sectors. This has been a central part

of public health since the mid-19th century (Beaglehole et al. 2004), and continues to be pivotal.

The Institute of Medicine's definition of public health illustrates this point: "Public health is

what we, as a society, do collectively to assure the conditions in which people can be healthy"

(ihi.org). This definition suggests the need for cooperative behavior. In its absence, the benefits

of public health will only be seen by those who are in the advantageous sections of society. A

clinical survey done by Steihaug et al. in Norway assessed the importance of collaboration

within the healthcare system. It was found that the provider's collaboration was hampered by

organizational and individual factors[3] (Steihaug et al. 2016). This lack of collaboration between providers impeded clinical work. Mental health service users experienced fragmented services which led to insecurity and frustration, and the lack of collaboration resulted in poor rehabilitation services and lengthened the stay for older patients (Steihaug et al. 2016).

Governments are indispensable to ensuring that these collaborative actions are met in order to promote population-wide health improvement. When a state devalues this in favor of individualism, the public health system is weakened and the overall progress of our health goals[4].

Third, in order for it to be successful, public health must take a multidisciplinary approach. In the past, public health has been dominated by the quantitative sciences at the cost of other sciences (Beaglehole et al. 2004). However, as Beaglehole et al. notes, "public health training programs should include opportunities to study the full range of quantitative and qualitative sciences" (Beaglehole et al. 2004). The challenge with this is that there are only a few educational systems that can provide these courses, and they primarily exist mostly in developed countries. Therefore, it is not only imperative that we improve the function of public health systems themselves, but also work to increase the availability of educational systems to teach healthcare providers integrative strategies to use in the field. A study by Xena Dion on a community in East Somerset, Pennsylvania showed that collaboration with other disciplines and agencies lightened the workload for medical professionals, and patients benefited directly from this multidisciplinary approach (Dion, 2004).

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[3] Including: differences in professional power, knowledge bases, and professional culture.
[4] Iris Young speaks to this point in her book, Inclusion and Democracy, which I will discuss more in Chapter 5.

The fourth key to a successful public health system is political engagement in public-health policy. An important matter that public health practitioners need to understand is the highly political process of developing health policies. Public health officials have long neglected or even evaded this connection. The government plays a unique role in public health because of its responsibility to protect the public's health and welfare, and because it can undertake specific programs that involve regulation, the expenditure of public funds, etc. that cannot be carried out if it were to be left to small groups or individuals. A great example of this is the US immunization policy. State legislators are faced with decisions related to increasingly complex disease schedules and recommendations, and also need to protect the public's health against the difficulties of funding and to the individuals who object to mandatory immunization recommendations (NCSL.org). Despite this, the US immunization policy has been extremely successful. Immunization programs are invisible to the public when they are working well, and a recent economic analysis done by the CDC indicated that vaccination of each US birth cohort with the current childhood immunization schedule prevents approximately 42,000 deaths and 20 million cases of disease, with net economic savings of $14 billion in direct costs and $69 billion in total societal cost (CDC.gov).

Lastly, community partnerships are something that need to be discussed in public health dialogue. In order to know how to implement public health practices best, it is vital to work with many of the diverse communities that are being served. This is the most important of all partnerships for public health practitioners. Community partnerships are also needed for building the long-term community and political support for efficient health policies. Involving

communities allows the opportunity for various population groups to negotiate their inclusion in health systems and to request a full range of public health services.

In such a practical and multidisciplinary activity as public health, acting ethically and fulfilling ethical obligations requires not only careful reflection but also intentional decision making. Not only is defining and measuring "health" a challenging endeavor, but "public" is also a complex concept that requires some unpacking. The public can be used to mean the numerical public, that is the population as a whole. The public can also mean what we collectively do through government and political agency (political-public). Lastly, the public can be looked at as what we do collectively in a broad sense, which includes all of the forms of social and community action affecting public health (nih.gov).

Dawson explains, "the public in public health has two meanings that are important for consideration: first "public" in that the aim of public health is to protect or promote health at a collective, community, or population level; second "public" in that public health involved collective, generally state, action" (Carter et al. 2012). Public health ethics therefore requires thinking at the public level, not just the individual level. This often requires trade-offs between the well-being of the community vs. the well-being of the individual. In public health, we are almost always forgetting to weigh up the benefits and harms across problems and populations, creating winners and losers, commitments and missed opportunities. Where people live and whether they can afford care makes all the differences in how they can access the services they need, whether those serve emergent situations or chronic disease.

An example of this is the growth of ambulatory surgical centers and urgent care centers. These settings are often alternatives for going to a hospital[5] for an emergent situation. For a middle to upper-middle class family, this is beneficial. To save a trip to the hospital and instead go to an outpatient clinic such as those above is much more attractive. However, many of these alternative settings are for-profit businesses, in contrast to most hospitals which are not. Furthermore, the locations of these centers target patients who can afford these services, not necessarily those who need them (MFFH.org). This exclusion of those who cannot afford services is becoming a central issue of public health[6].

To sum up, the five key characteristics that are imperative to the success of modern public health are: health systems leadership, collaborative actions, multidisciplinary approach, political engagement in public health policy, and community partnerships. Health care itself isn't a political process, but the development and implementation of health care policies are. Therefore, using political theory could possibly enable us to understand feasible ways to improve it. Infectious diseases such as Dengue virus are prime examples of how important these ideals are to the effectiveness of public health[7].

So far, we can see how potent and impactful public health can be and how much its philosophy affects patients[8]. One of the main tensions present in the field of public health, therefore, is how the state should make decisions and enforce policies related to the health of the

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[5] A New York Times article explains how the number of hospitals in the US is actually decreasing. Despite the increasing attractiveness of hospitals in the 19th century (X-rays, anesthesia, MRI, surgical robots, etc.), today hospitals seem less therapeutic and curing but rather more life-threatening. The number is also declining due to the fact that more complex care can now be safely and effectively be provided elsewhere.

[6] I will discuss this point more in Chapter 4.

[7] I will discuss this point more in Chapter 4.

[8] And doctors, as explained by Dion, 2004.

public, while simultaneously respecting the individual right and autonomy of its citizens. As we saw with the US immunization program, such political efforts can not only save lives but also are hugely beneficial to the economy.

Dengue virus is one of the most important viruses of the century. The impact DENV infections have on human health is enormous. DENV infections are responsible for 390 million global infections per year (WHO.int). Risk factors for the severe hemorrhagic form include prior infection with a different serotype, strain of the infecting virus, age, gender, nutritional status, as well as the genetic background of the patient (Chen and Vasilakis, 2011). Due to the underreporting of the disease as well as insufficient use of various health services (especially in resource poor countries), we do not know the true economic and health burden of DENV. While on a community and national level these facts are staggering, on the individual level the costs associated with DENV infection significantly exceed the average monthly income of the patient (Beaute et al. 2010). Therefore, Dengue therefore gives us a great eyeglass to look at public health and the ramifications of inadequate infrastructure.

Chapter 2: Dengue and public health

To understand the importance of Dengue, we must first understand what Dengue is. As I explained at the end of my last chapter, Dengue (DENV) gives us the perfect lens upon which to examine public health. In this chapter, I will give you an overview of its prevalence, what the virus is and its symptoms, how it is spread, as well as the current problems with the way it is being handled.

DENV is a virus, and is one of the most important arboviral diseases (viruses that are transmitted by arthropod (mosquito) vectors[9]) of humans in the 21st century. Dengue occurs in tropical countries of the world, where more than 2.5 billion people[10] are at risk for infection (WHO.int). The number of cases reported to WHO has increased 15-fold over the last 20 years[11] (WHO.int). While the increase in the number of cases increases as the disease spreads to new areas is concerning, it is not the most troubling fact. Not only is the number of cases increasing, but these outbreaks are explosive (WHO.int). Now, the threat of a possible outbreak of DENV exists in Europe as local transmission was reported for the first time in France and Croatia in 2010, as well as imported cases detected in three other European countries (WHO.int).

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[9] See **Figure 1** for transmission cycle.

[10] Compare that to the novel coronavirus (COVID-19/SARS-CoV2) infection rate of two million (as of April 23) (WHO.int).

[11] This increase is partly due to a change in national practices to record and report Dengue to the Ministries of Health and WHO, but it also represents the recognition of various governments of the burden.

Of these tropical countries, more than 100 have endemic[12] Dengue virus infection, and

Dengue Hemorrhagic Fever (DHF) has been documented in more than 60 of those countries.

Distribution of dengue, worldwide, 2016
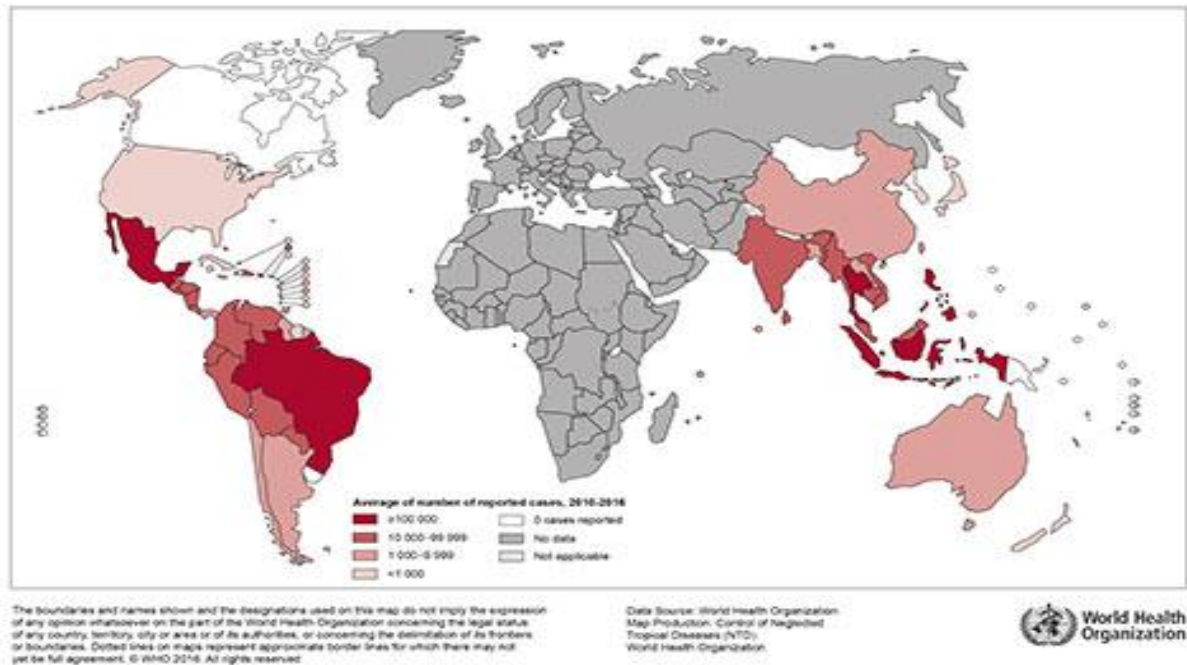
Figure 2. Global distribution of DENV in 2016 (adapted from WHO.int).

While a risk of infection exists in 129 countries, 70% of the actual burden is in Asia

where the virus is the leading cause of hospitalization and death among children (Bhatt et al.

2013). In the American tropics, DHF was a rare disease before 1981, but since then, epidemic

DF/DHF has become one of the most critical public health problems in the region (Chen and

Vasilakis, 2011). The incidence of Dengue has increased dramatically between 1990 and 2013,

with the number of cases more than doubling every decade, from 8.3 million in 1990 to about

58.4 million in 2013 (Bhatt et al. 2013).

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[12] Endemic means that the virus is regularly found in a certain area.

Most DENV infections are subclinical or result in the classic Dengue fever, which is characterized below. However, about 0.5% of these infections result in the most severe form of this disease, Dengue Hemorrhagic Fever, which can be fatal in as many as 5% of cases (Vasilakis et al. 2011). Infection with Dengue results in a broad spectrum of clinical symptoms accounting for a range of classifications of the disease. Dengue has the classic flu-like symptoms (fever, rash, headache, myalgia, arthralgia, nausea, and vomiting) with or without the warning signs of abdominal pain, persistent vomiting, or mucosal bleeding. Severe dengue is characterized by plasma leakage, with or without hemorrhage (WHO.int). There are four different serotypes of Dengue (DEN 1-4), and infection with one of the serotypes does not provide immunity against the three others, and increases the risk of hemorrhagic fever upon infection by another serotype (Chen and Vasilakas, 2011).

Some of the factors of Dengue resurgence are not well understood. The demographic and societal changes that have occurred in recent years have contributed significantly to the increased incidence as well as the geographical spread of Dengue activity (Chen and Vasilakas, 2011). Population growth, urbanization, and modern transportation are some of these factors. The increased activity of the multiple virus serotypes has increased the rate of genetic change in viruses and therefore has increased the probability of the emergence of new virus strains as well as genotypes with higher virulence (Chen and Vasilakas, 2011). In the past 20 years, new virus strains have been detected with increasing frequency in new geographical areas, some resulting in transmission and others in silent transmission. Silent transmission occurs when patients appear asymptomatic but are infected with the virus. A study done by Perkins et al suggests that patients with this asymptomatic DENV infection are 80% as infectious as the symptomatic patients

(Perkins et al. 2015). This has increased the probability of secondary Dengue infections, which can be fatal (Gubler, 2002).

The emergence of Dengue as a significant public health problem has been the most dramatic in the American region. DENV-3 (a Dengue serotype) has reappeared in the Americas after an absence of 16 years (Gubler & Clark, 1995). A new DEN-3 virus strain has also been identified, and will most likely spread rapidly through the region due to the susceptibility of the population and will cause significant dengue epidemics in the near future (Gubler & Clark, 1995). As of February 9th of this year (2020), the Pan American Health Organization reported 320,000 suspected and confirmed cases in the Americas, with Brazil being the hardest hit at 167,000 cases.

There is no specific treatment for DENV, but early detection and access to proper medical care lowers fatality rates to below 1% (WHO.int). The surveillance of Dengue Fever/Dengue Hemorrhagic Fever (DF/DHF) is inadequate in most of the countries affected, so the number of cases that occur each year are only estimated, and the real impact of the virus can be much higher than we currently believe.

The presence of the mosquito vector, *Aedes*, heavily influences the transmission intensity of the virus. The success of the mosquito depends on the climatic conditions and the availability of breeding sites (Gubler, 2002). These breeding sites are formed and favored with the lack of basic sanitation, garbage collection, water supply as well as inadequate water storage (Spiegel et al. 2005). Due to this, urban areas meet all the requirements for active transmission of dengue, providing not only the preferred sites but also a close proximity to human habitats as well as high

population density. One can see how easy it is for infection to not only to occur, but create an explosive outbreak in urban populations.

The real public health impact of Dengue happens during epidemics of the disease. Because surveillance is so poor, the early stages of the epidemic transmission are usually not detected. Due to this, the response is always too little and too late. The result of poor infrastructure is the overloading of clinics and hospitals by patients with DF or with mild non-dengue illness, and overworked medical staff which leads to substandard care for patients with the threatening DHF/dengue shock syndrome and often increased mortality[13]. In large epidemics, there is often chaos and confusion among the populace which can lead to the spread of misinformation and severely impact the well-being of the community.

The economic impact of Dengue is challenging to measure as few studies have been attempted. However, the total impact of DF/DHF is on the same order of magnitude as many other major infectious diseases such as malaria, tuberculosis, hepatitis, bacterial meningitis, and others. In Latin American countries, Dengue imposes a substantial economic burden. In Brazil, the estimated cost for communities affected in the epidemic season of 2012-2013 was US $468 million, and for Mexico, the cost was around US $170 million (Laserna et al. 2018). A major cost driver is the mosquito prevention programs, which accounts for about 64% of these overall costs (Laserna et al. 2018). A study published in 2013 estimated that in that year, there were 58 million symptomatic Dengue virus infections, including 13,586 fatal cases, and the total global cost was US $8 to $9 billion (Shepard et al. 2013). These case studies clearly show that the

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[13] We saw how a fast spreading disease can severely overrun hospital systems and health care workers, as evident of the SARS-CoV2 (novel coronavirus) outbreak this year, in 2020.

global cost of Dengue is substantial. If control strategies are introduced, billions of dollars could be saved globally.

In most countries that are affected by Dengue, the public health infrastructure is very poor. There are limited financial resources as well as human resources. Many of these countries have also chosen to adopt the crisis mentality, which involves implementing emergency control methods in response to epidemics rather than developing programs to prevent epidemic transmission (Gubler & Clark, 1995). This particular approach is problematic to Dengue control because the surveillance of the virus is very inadequate in many countries, and this system relies too heavily on local physicians who usually do not consider Dengue as a possible illness in their initial diagnoses.

Despite the recognition of Dengue fever as the most important arboviral disease that infects humans and despite the greater emphasis of community-based control approaches, the burden that is placed on communities, countries, and regions that this disease affects continues to rise (Spiegel et al. 2005). In today's climate of emerging infectious diseases among global socioeconomic changes, change needs to not only be integrative but also adaptive approaches that are able to recognize the complexities of these evolving socioeconomic systems. An interdisciplinary approach is the most effective route[14]. Building bridges between disciplines and decision-makers that are not typically in the network of "disease control" can help to recognize institutional and knowledge related barriers that must be overcome to achieve collaboration (Spiegel et al. 2005).

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[14] As discussed in Chapter 1.

Some programs that might be beneficial to enforce include: mosquito control, community ownership, partnership with government, leadership, scale and adaptability. I will explain each of these programs in the following paragraphs.

Programs that only rely on eliminating mosquitos are doomed for failure as shown in Gubler, 1989 and Newton and Reiter, 1992. The emphasis should therefore be placed on interrupting the transmission cycle at an early phase through immature mosquito control (Spiegel et al. 2005). This can include a number of things including, but not limited to, destroying eggs and larvae or getting rid of breeding grounds.

Recognizing the importance of mobilizing and channeling household-level behaviors by reducing exposure is what is meant through community ownership. This "community" must take into account the geographical and political factors that are specific to a local context, and understand the multicultural complexity (Spiegel et al. 2005). This community engagement must be achieved by reinforcing local ownership of the efforts and not just passively conveying the information that has been developed outside of the target community[15].

The role of the government in coordinating productive efforts cannot be overlooked or underestimated. Gubler et al. 1989 states that without a coordinated approach, the successful implementation of control programs is unlikely to be achieved[16]. The likelihood of success is further enhanced if a wide range of local and regional partners are involved in the effort, and the government can facilitate and extend this process (Spiegel et al. 2005).

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[15] We can see how important community ownership is in the current climate of SARS-CoV2. Without the commitment of the community, the disease will continue to work its way through the population.

[16] This coordinated government approach was what made the US immunization program so successful, as described in Chapter 1.

Leadership at the local levels also guides the establishment and following through of these programs, and can have the ability to create buy in by members of the community. These local leaders have the ability to have knowledge of the neighborhood practices, and may be better able to control things such as mosquito breeding sites by enlisting community members to participate (Spiegel et al. 2005).

It is clear to see the importance of understanding Dengue infection as it is one of the most prevalent diseases of modern day. What is more important is that we understand that its impact far exceeds that of health. The economic burden it can place not only on individuals but also on a national economy. Therefore, we can see that as important treating the disease is, how the framework of that treatment is created and enforced carries as much, if not more, importance.

Chapter 3: Inclusion and Democracy Discussion

In Iris Marion Young's book, *Inclusion and Democracy* she argues that democratic equality requires that everyone whose basic interests are affected by policies should be included in the process of making them, and that the scope of polity[17] at two levels: global and local.

She opens up discussion about how the process of decision making and debate can often be exclusive in the fact that it marginalizes individuals as well as groups. This marginalization is not only due to the group or individual's lesser social and economic power, but also due to the norms of political discussion and their bias to some forms of expression and communication. Young argues that democratic theory should include forms of acknowledgement, narrative, rhetoric and public protest. She also argues that inclusive democracy requires taking special measures to compensate for the social and economic inequalities of unjust social structures.

Young states that "democratic process is the best means for changing conditions of injustice and promoting justice" (17). Young establishes that there are significant advantages of democracy. She thinks that it is the best political form for preventing rulers from abusing their power. In principle, democracy is the only way that all members of a society can have the opportunity to influence public policy in order to protect their interests. However, in the real world, there are people and groups who have a significantly greater ability to use these democratic processes to promote their needs and desires, while others are often excluded and marginalized. In many democratic systems, there tends to be a reinforcing circle between said social and economic inequality as well as political inequality that enable those who are in power

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[17] Polity refers to "the state," or, the commonwealth/community.

within the democratic system to continue to use the democratic process to prolong injustice and preserve their privilege. Young argues that a way to break that circle is to widen democratic inclusion.

Young gives us two models of democracy which focus less on the frameworks of democracy, and more on the decision-making process. The first model Young discusses is the Aggregative Model, which is the process of aggregating the preferences of citizens in choosing public officials and policies and asks the question, "what decisions correspond to the most widely and strongly held preferences?" In the Aggregate Model voters pursue their own individual interests, such as the changes they would like to see in their own lives, as well as politicians. Politicians do so by adopting policies that will buy them votes. In this model, the only reason democracy is there is to provide a way to identify and aggregate the preferences of citizens to see what ideas are the most widely held. This model therefore involves a sense of democracy that rests on individualism and offers, according to Young, "no way to evaluate the moral legitimacy of the substance of decisions" (24).

The second model of democracy is the Deliberative Model. In this model, political discussion and criticism is characterized by participants aiming to persuade one another of the rightness of their positions. In this model "participants arrive at a decision not by determining what preferences have greatest numerical support, but by determining which proposals the collective agrees are supported by the best reasons" (23). This entails several normative ideals such as inclusion, equality, reasonableness, and publicity.

Moving towards a wider discussion of democracy, Young explains that in the sphere of inclusion the democratic process is only legitimate if those affected by the decision are included

in the process of discussion and decision making. Inclusion then allows for the maximum expression of interests, opinions and perspectives that are relevant to the issues for which the public is seeking solutions. Not only should all those affected be included, but they should also be included on equal terms. This is the backbone of political equality. Individuals should have the opportunity to express their interests and concerns, and participants "must be equal in the sense that none of them is in a position to coerce or threaten others into accepting certain proposals or outcomes" (23). Reasonableness is also important in democratic discussion because when individuals are willing to listen to others[18], they enter discussions to solve collective problems with the aim of reaching agreement. Lastly, democratic discussion must also have publicity in the fact that the members of the discussion have multiple different individual and collective experiences.

The Deliberative Model is therefore more suitable to the set of values that brings us to appreciate the democratic process. This model gives individuals and groups the ability to promote and protect their interests in politics as well as policy, and allows participants to move from self-interest to a more public orientation. In an ideal model of deliberative democracy, all those whose basic interests are affected by a decision are included in the process.

Democracies today do not directly enact injustices[19], but their policies and processes often reinforce or even fail to change the social and economic injustices they nevertheless create. Therefore, it is important that we call for political equality and inclusion because "political

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[18] The way Young uses the term, reasonableness always entails listening to what others have to say.

[19] It can be argued that the US still contains systemic inequality, which is true. For the sake of my argument, what I am referring to here is the deliberate intention of creating injustice for its people from the fact that not all individuals whose lives are affected by policies are included in the decision-making bodies that create said policies.

outcomes can only be considered morally legitimate if those who must abide by or adjust to them have had a part in their formation" (53). In order to address exclusion, we need to know the forms of exclusion that exist. The many different ways that individuals and groups who ought to be included are purposely or unintentionally left out of the discussion or decision-making process is called external exclusion. External exclusion gives economically or socially powerful groups the ability to obtain and exercise political domination. Internal exclusion, on the other hand, is when individuals lack effective opportunity to influence the thinking of others even when they have access to the decision-making process. Young theorizes three modes of communication which can mitigate said exclusions; greeting, rhetoric and narrative.

Young defines greeting as "the communicative moment of taking the risk of trusting in order to establish and maintain the bond of trust necessary to sustain a discussion about the issues that face us together" (58). According to Young, greeting allows the speaker to announce their presence as ready to listen. Greeting has an important place among parties who have problems or conflicts as the gesture shows mutual respect among the parties, opening up discussion.

Some theorists believe that the only way one should speak within a deliberative democracy is with rational speech, that "rational democracy will engage in the mind rather than ignite the passions" (63). Young argues that this mode of speech is exclusive and should not be the only acceptable form of discussion. She believes that rhetoric is important towards political communication. She gives the example of demonstration and protest; the rhetoric in these forms of political engagement often helps to get the issue on the agenda for deliberation (66). By saying that rational speech is the only speech that is accepted in democratic processes, we

exclude individuals and groups who have not had the opportunity to learn and practice rational speech.

Lastly, Young proposes narrative as a way of combating exclusion. Some exclusions occur because participants in a political public do not have shared understandings. Narrative serves as a way to foster understanding among members with different experiences. Young argues that "where we lack shared understanding in crucial respects, sometimes forms of communication other than argument can speak across our differences to promote understanding" (72). Political narrative, therefore, furthers discussion by bridging the gap of difference. Narrative not only gives a voice to those who are oppressed, but also allows outsiders to come to understand why the insiders value what they value and why they have the priorities they have. It is in this way that narrative reveals greater social knowledge thanks to the expression of different points of view.

There are many critiques of a politics of difference[20], but Young argues that only a politics of difference provides possibility for achieving objective, public discussion of real differences, rooted in structural inequalities and sometimes cultural conflicts involving identity politics and misrecognition of others. Young emphasizes that we cannot put politics into groups because members of groups do not share essential, distinguishing characteristics in common. Although a kind of non-essentializing "identity politics" is possible (which involves the repudiation of negative stereotypes, the creation of solidarity through exchange of common narrative, and the struggle to maintain control over one's culture as exemplified in the struggle of

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[20] Politics of Difference is a theory created by Young, in which equal treatment of individuals does not override group-based oppression.

indigenous people), most politics of difference is really about rectifying structural and not cultural injustices. Young believes that social differences are about structural positions not identities. People have identities, not groups. Said persons make their own identities, however they do not make them under the conditions that they choose.

In mass politics, a frequently heard complaint of exclusion involves the norms of representation. Recent calls for greater political inclusion in democratic processes argue for measures that encourage more representation of under-represented groups, especially when those groups are minorities or subject to structural inequalities. However, the use of group representation, according to Young, can be detrimental to inclusion. Group representation assumes that a group has some set of common attributes of interests that can be represented (122). Young argues that this is usually false. Members of groups usually have different life histories that therefore make them very different people that have different interests and commitments. This so-called "freezing into a unified identity" as Young puts it, re-creates oppressive exclusions.

Under this critique, no single representative could speak for a group because there are too many intersecting relationships among the individuals that comprise it. However, group representation might be the best way to gain a voice for the many who are wrongly excluded from issues. Within Chapter 4, Young argues that being positioned in a particular social field allows for a social perspective that should be shared with others, and which through public discussion with representatives can be achieved.

No one person can be present in all the decisions as well as the decision-making bodies that affect their lives, therefore representation is necessary. As Robert Dahl argues, the equal

participation of everyone in political deliberation can only happen in small communities (125).

Young explains how it is impossible to find the essential attributes that make up a common good

that permeate with equal usefulness throughout a larger community. Her solution to this is that

political representation needs to be thought of as a process that involves the mediated relation of

constituents to one another as well as to a representative. This means that in order for there to be

successful representation, the citizens must be active within themselves to agree on what

constitutes their "common good," and must effectively relay this to their representative.

The responsibility of this representative is to participate in discussion and debate with

other representatives. She should listen to others' questions, arguments, stories, and appeals, and

with them try to arrive at wise and just decisions. Young talks about how the major problem with

representation is the threat of the disconnection between the single representative and the many

that she represents. When this separation occurs, constituents lose the feeling that they have

influence in policy-making, and then withdraw their participation. Without this participation,

Young states that "the connection between the representative and the constituents will break,

turning the representative into an elite ruler" (132). Therefore, citizen participation is also very

important, and it is in this way that we see that inclusion takes effort. Inclusion is not simply

given to the citizens from those in power, it is fought for by those who seek it.

Young also discusses the special representation of marginalized groups (Ch 4). She

discusses how the increase in inclusion of under-represented groups can help a society confront

and find remedies for structural social inequality. It is important to maximize the freedom of

speech, and cooperation should be the general principle that guides the representation of interests

and opinions (147). She also considers the idea of reserving a specific number of seats or

positions in a representative body for the representatives of a particular group, but then states that this reservation of seats tends to freeze both the identity of that group and its relations with other groups within the polity (149).

Chapter 5 discusses civil society[21] and its limits. There are many advantages to a civil society. Young states that civil society "promotes trust, choice, and the virtues of democracy" and "enables the emergence of public spheres in which differentiated social sectors express their experience and formulate their opinions" (155). The public sphere allows the citizens to expose injustice in state and economic power, and make the exercise of power more accountable. Since many of the structural injustices that produce oppression have their source in private economic processes, state institutions are necessary to combat oppression and promote self-development.

Private associations involve groups such as social clubs, families, and religious organizations. Young states that these associations tend to be more inward-looking. Civic associations, on the other hand, are primarily directed outward from those engaged in them to others. These associations aim to not only serve members, but also the wider community. Unlike private association, "civic association tends to be inclusive in this sense that it is open in principle to anyone" (161). Most of these civic associations rely on volunteers and donations in order to carry out their work. Young explains that there is nothing wrong with private association in a big society, as long as the citizens and associations respect each other and are willing to do their part in order to contribute to the wider society.

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[21] Civil society is defined as a society considered as a community of citizens linked by common interests and collective activity.

Lastly, she explains political association, which is distinct from both civic and private association. Political association "self-consciously focuses on claims about what the social collective ought to do" (162). Many aims to influence the state policy formulation or implementation. This political activity relies on a public sphere[22].

Civic associations move to a political level when they find that their ability to accomplish their goals is hindered by the policies and practices of powerful agents in the state or economy. Young explains the benefits for the individual involved in a civil society, saying that the self-organizing activities of a civil society contribute to self-determination and self-development by supporting identity and voice (165). It is in this way that civil society allows for the oppressed to gain a voice as those who are marginalized can find each other and form associations to improve their lives. Young believes that "democracy and social justice would be enhanced in most societies if civic associations provided even more goods and services" (166). She goes on to explain that civic organizations are important promoters of development in the fact that they improve the lives of some disadvantaged people by involving them directly in participatory projects.

Within the public sphere, citizens should have "formal access to both indoor and outdoor spaces for the staging of public events aimed at calling attention to issues, expressing opinions, and calling for action" (169). At the center of the public sphere is discussion, and making sure that the discussion has equal participation is essential. In societies with social and economic inequalities, the public sphere can become dominated by privileged groups. Although the access

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[22] This is where the political action of health care reform lies, as I will explain in Chapter 4.

may be the same for all, the availability of resources for the wealthy (power, influence, information) make the access easier for some than others.

Young states that democracy, traditionally defined as a political system in which elite decision-makers are elected and subject to the rule of law, is better thought of as a process that *connects* the people and the powerful, and through which "people are able significantly to influence their actions" (173). The public sphere, according to Young, is the primary connector between people and power. Within this public sphere, political actors raise issues, give opinions, and propose new practices and policies. When these issues are widely discussed, it can sometimes provoke social and political change. The public sphere also allows citizens to hold the powerful accountable, and Young says "accountability fueled by civic public spheres can help keep the actions of the powerful within the law and minimally honest" (175). Young goes on to say that exposure, or public shame, is an important means of breaking the circle where social and economic inequality reinforces political inequalities.

At the end of Chapter 5, Young describes how citizens should not rely on states to solve social problems. On page 182, she writes that "good citizens are independent and autonomous, rather than dependent on others, at the same time that they manifest a commitment to promote the well-being of others and of the institutions and values of the community."

Chapter 6 discusses residential segregation and regional democracy. She discusses how structural locations give rise to different social perspectives. On page 196 she states, "residential segregation enacts or enlarges many material privileges of economic opportunity, quality of life, power to influence actions and events, and convenience." This segregation impedes

communication among the segregated groups. The residential segregation has far-reaching

consequences for democratic practices.

Firstly, segregation violates the principle of equal opportunity and as a result, impedes

political communication among the segregated groups, making it difficult to address the wrongs

of segregation through democratic political action (205). This segregation "makes privilege

doubly invisible to the privileged: by conveniently keeping the situation of the relatively

disadvantaged out of sight, it thereby renders the situation of the privileged average" (208).

Segregation thus prevents those with privilege from being exposed to the injustices in their

society.

Young believes that class segregation endangers democracy in at least three ways. The

first is that it discourages public spaces and public encounters. Secondly, it impedes

communication between groups. And lastly, by segregating themselves into separate political

communities, those more well off can abandon a sense that wealthier citizens share problems

with their less well-off neighbors, and should cooperate with them to produce a greater public

good. Young offers us the idea of clustering. People desire to live and associate with others for

whom they feel a particular affinity, and this residential or civic clustering is not in itself wrong.

It can actually be beneficial in the fact that the "clustering of the group can serve as an important

source of self-organization, self-esteem, relaxation, and resistance" (217). This process is good

as long as the clustering does not exclude others from access to benefits or opportunities.

Young concludes this chapter by arguing that everyone has a responsibility for justice.

The scope of obligations to justice are global. Every person dwelling in the same area is obliged

to do what he or she can to constitute and support institutions of collective actions organized to

bring about relations of justice among persons, or in other words, political organizations.

Chapter 4: Inclusion and Democracy in Relation to Public Health in America
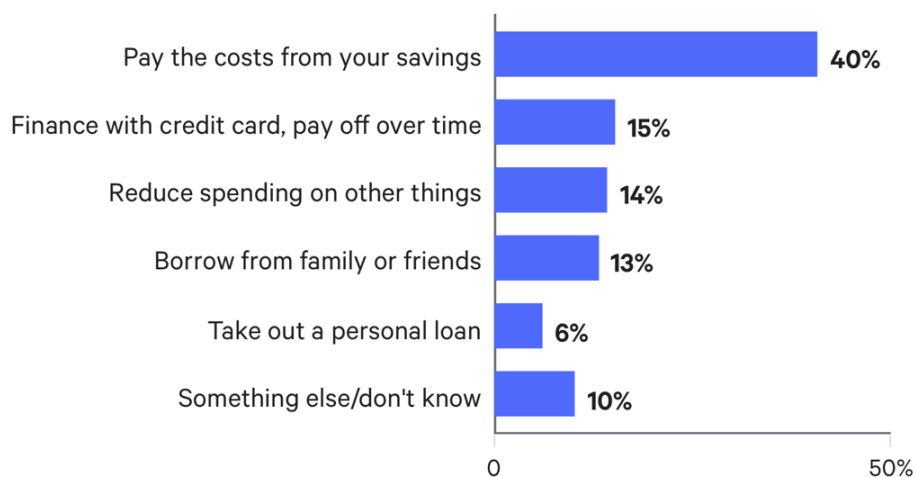
Many of Young's ideas about political theory are extremely relevant to health care and even public health reform. Health care itself isn't a political process, but the development and implementation of health care policies are. Therefore, using political theory could possibly enable us to understand feasible ways to improve it. Most Americans place a substantial amount of confidence in our current healthcare system for when they come down with a serious illness or an unexpected injury. However, due to the expense of healthcare in America can almost hurt as much as it helps. There are frameworks already that can help us navigate this road, and I will explain them in this chapter in conjunction with Young's arguments.

American health practice is an example of a market approach, in which the method of determining the price of care (an asset) is based on the similar price of other assets. This model aims to limit the responsibility of the government for public health, and instead encourages individual responsibility for the improvement of one's own health (Beaglehole et al. 2004). While there are some benefits to the system, there are numerous disadvantages to this individualistic approach. In the US, appointments can be challenging to get, emergency rooms or urgent care clinics are often overcrowded, and even the advice given by doctors can be challenging to interpret, understand and act upon. Even after the battle with the diagnosis is over, many find themselves in a battle with the amount of bills that follow. 137 million Americans are struggling with medical debt as of 2019 (Yabroff et al. 2019). A study done in 2017 found that 66.5% of all bankruptcies were tied to medical issues, which was either due to high costs for care or time out of work (Himmelstein et al. 2017). This is not exclusive to those who are in low-

income brackets. A recent survey from Bankrate found that only 40% of Americans could pay a

$1,000 emergency medical expense from their savings (Figure 3), (Garcia, 2019). This can

sometimes be more devastating than the diagnosis itself.

We asked: How would you deal with a major unexpected expense?

If you had a $1,000 bill for something such as an emergency room visit or car repair, would you ...

Pay the costs from your savings	40%
Finance with credit card, pay off over time	15%
Reduce spending on other things	14%
Borrow from family or friends	13%
Take out a personal loan	6%
Something else/don't know	10%

Note: 3% of respondents refused to answer. Percentages might not total 100 due to rounding.
Source: Bankrate's Financial Security Index, Jan. 2-6, 2019

Bankrate

Figure 3. Survey of Americans on how they would deal with an unexpected medical

expense (adapted from Bankrate).

Several of the consequences of illness, like the psychological effects, are a part of being

sick. However, the current healthcare system in America places unwanted consequences upon

patients. The population has great expectations for their health care, which is due in part to the

fact that news stories are constantly reporting on medical miracles and advances. For people

reading them, they then believe that if or when an illness strikes, their medical professionals will be completely prepared to not only make the diagnosis but also successfully treat it. For such a promising view on the health care system, the burdens of illness would not be too hard to handle.

Sadly, this is not the case. Often when people fall ill, they struggle to not only have to obtain the effective treatments and services, but also have to struggle with other significant issues with the healthcare system; 61% of people with an illness report at least one problem while receiving care (Commonwealth Fund). This could include understanding a medical bill, what their health insurance covers, being sent for duplicate tests, or even receiving conflicting recommendations from different health professionals (Commonwealth Fund). One can see how these misunderstandings can add up in a medical bill. Unnecessary tests can prove to be extremely costly as well as dangerous. Moreover, this financial burden doesn't stop when the illness is over; it causes long-term financial problems for many, and the burden often extends beyond the individual to their entire family.

While health care can be incredibly expensive for anyone, it places the biggest burden on those with serious illnesses. Millions of Americans are financially ruined by the costs of their treatment. While the majority have health care, one in ten Americans are uninsured (Commonwealth Fund). Even with coverage, the insurance may not be able to protect the individual from these health care costs. In a survey, 53% of people with a serious illness experienced one or more dire financial consequences that were related to their health care (Commonwealth Fund). A dire financial consequence could include using up most or all of their savings, being unable to pay for necessities (food, heat, or housing), or having to borrow money

to get a loan or another mortgage. All of this was despite 90% of those surveyed having insurance coverage.

A staggering fact is that even after the Affordable Care Act was passed, it did not change the proportion of bankruptcies due to medical cases (Himmelstein et al. 2017). In fact, the number of debtors that cited medical expenses as a contributing reason for their bankruptcy increased after ACAs implementation, from 65.5% to 67.5% (Himmelstien et al. 2014). The author of the paper I have referred to here, states "unless you're Jeff Bezos, people don't have very good alternatives, because the insurance that is available and affordable to people, or that most people's employers provide them, is not adequate protection if you're sick" (Konish, 2019). Even in the event that an individual can afford health insurance or an employer provides it, it is often similar to a hospital gown in the sense that it looks like coverage until you actually inspect it.

In Dickman et al., the authors explain how the healthcare industry transformed in the 20th century from a charitable service to a market-driven enterprise. This has resulted in lopsided financial burdens for citizens, and in other developed countries they have combated this problem by implementing policies that are able to offset the market tendencies either by national health programs or by tightly regulating private insurers and health care providers (Dickman et al. 2017). The USA has no means by which to regulate the market-like nature of private insurers/providers, in part due to the fact that low-income voters, who are those that are most negatively affected by the market, are divided by racial hostility (Dickman et al. 2017). Racial and ethnic inequalities in health insurance coverage rates account for a considerable share of the difference in access to health care (Lillie-Blanton and Hoffman 2005).

While what I mention above seems to follow diagnoses, these issues are not exclusively a consequence of becoming sick**.** These impairments are more a consequence of how our health system operates. There are strategies for developing and delivering a better health care experience that already exist, and they just need to be adopted and applied on a much wider scale. In what follows, I will propose and argue for four of these potential strategies, as developed by the Commonwealth Fund[23], along with their connections to Young's theory.

The first strategy is to *build the capacity to identify and manage the behavioral health needs of patients and their caregivers.* The introduction of multidisciplinary thought into health care can help to ease the sense of helplessness, loss and social isolation that is commonly experienced in illness. Requiring behaviorists, social workers, physicians and patients to work together will allow this to happen (Commonwealth Fund). Young also articulates the need for multidisciplinary thought by stating that "well-organized states accomplish large scale collective goals by facilitating social coordination among individuals and groups"[24] (186). Here, Young is discussing the importance of coordination in politics, the idea is applicable to healthcare systems: well-organized health care systems can accomplish large scale collective goals (improvement in patient's health or improvement of overall health care in a community) by facilitating communication amongst many individuals across disciplines. Understanding of the patient as a complete person instead of a container of symptoms has the potential to not only improve their

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[23] The Commonwealth Fund was founded by Anna M. Harkness in 1918, the mission of The Commonwealth Fund is to "promote a high-performing healthcare system that achieves better access, improved quality, and greater efficiency, particularly for society's most vulnerable, including low-income people, the uninsured, and people of color." (Commonwealthfund.org)

[24] While this can also be used to show the importance of collaborative action, which I explained in Chapter 1, I am using this quote by Young to show how necessary it is to take perspective from every discipline.

health but also their well-being in general, and therefore having healthcare professions from numerous disciplines is a crucial step towards improving the American healthcare system.

The second strategy is to *assess and address social service needs*. Since the impact of serious illness extends well beyond the medical realm (for example, the inability to work while dealing with the condition) access to and support for services like transportation, supportive housing, meals, etc. is critical to helping the ill maintain a desired level of well-being (Commonwealth Fund). Young agrees with this point as on page 166 she states, "democracy and social justice would be enhanced in most societies if civic associations provided even more goods and services." Allowing those affected by illness access to such goods and services could reduce multiple sources of stress. As discussed above, illness is not only experienced in hospitals, it can also carry over to every part of the individual's life, and therefore so must our health care.

These services could be provided by two different sources; either as a part of health care itself or through non-profit organizations. Young argues that nonprofits are actually a strong catalyst of democracy and should be implemented; "non-profit social services are often democratically organized, connected to their communities, and more empowering for clients than state-run services" (166).

To add to Young's analysis, I think the most powerful characteristic of nonprofits is their ability to be intimately connected to their community. Their understanding of the specific needs of people within a group can be more influential, beneficial and effective than using a big company (such as a hospital or insurance company) to address the out-of-clinic needs of patients. This sense of comradery may also benefit the patient as they develop a more meaningful

relationship with the nonprofit, as the nonprofit would (according to my theory) be responsible

for a smaller cohort, and therefore more time would be available to understand patient needs.

The next strategy is to *make it easier for patients, caregivers, and professionals to work in close coordination with one another.* Conversations should thus occur not only between

professionals in multiple disciplines, but also between these professionals and the patient

themselves. With the increased use of technology, this can easily be obtained by using tools such

as secure texting, email, telehealth or even social media platforms (Commonwealth Fund).

Young states that "men and women who are not directly responsible through common

deliberation, common decision, and common action for the policies that determine their common

lives are not really free at all" (126). While she means this on the scale of public policy and

decision making, it can easily be applied to this case by understanding the patient to be

analogous to a citizen, and the healthcare professionals to be analogous to the governing bodies

making policy decisions that affect the citizen's life. In medicine, the most important individual

is the patient. They are the ones who experience the symptoms, treatment, stress, financial

burden, etc. Therefore, why should *any* conversation be in their absence[25]? The freedom of the

patient should always be protected; their freedom to choose treatments, providers, and even their

timeline. By allowing them this freedom (whether they choose to utilize it or not is their

decision), they may feel more in control of their health, which may lead to an improved quality

of life and possibly a better health outcome.

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[25] Patients do often lack expertise in healthcare, and this is one of the main reasons why they are left out of decisions. Including patients in conversations does not mean that they are now the ones that are responsible for making their diagnosis and creating their treatment, but rather the benefit of the patient knowing why exactly this treatment is the best option and how the decision was made.

Patient participation within the decision making in healthcare and treatment is not necessarily a new area, but has recently become a political necessity in many countries and health care systems around the world (Vahdat et al. 2014). A literature review of various patient participation studies have shown many benefits, including but not limited to, increased patient trust, quality of life, reduced anxiety, and better understanding of personal requirements (Table 1) (Vahdat et al. 2014).

Selected Summary of Some Studies on Patients' Participation in Healthcare Decisions

Country of Study	Year of Study	Number of Participants/Study Population	Results
Scotland	2008	13	Participation as cooperation to understand information, not just seeking information
Sweden	2004	10	Participation as trusting, understanding, seeking and maintaining a sense of control
England	2000	44	The relationship of patients' involvement with underlying factors, type and severity of disease, and patient-specialist relationship
11 European countries	2000	330	The relationship of degree of patients' involvement with doctor-patient interaction, patients' desire to participate, patients' demographics (literacy, high mental agility)
Sweden	2006	26	The relationship between patients' involvement with knowledge, mental, physical and emotional capacity
Australia	2006	73	The effect of patient-doctor interaction (discussion, trust) and doctors' interpersonal skills on participation
Scotland	2007	20	The relationship between patients' involvement with factors of respectful and friendly behavior, non-judgmental approach, doctors' attention to patients' views, clear explanation by doctors
Sweden	2006	900	The relationship between patients' involvement and factors of provision of information and explaining it according to personal needs, staff acknowledgement of patients' knowledge

Table 1. Literature review summary of case studies of patient participation in healthcare decisions (adapted from Vahdat et al. 2014).

Furthering the analogy between politics and healthcare, consider Young's argument about equity[26] "without such citizen participation, the connection between the representative and constituents is most liable to be broken, turning the representative into an elite ruler" (132). The

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[26] Equity meaning the quality of being fair and impartial.

power of medicine is easily given to the physician; therefore, the physician is the representative of the patient. While they are the ones that have the educational ability to make diagnoses and provide effective treatments, they do have the ability to become the "elite ruler" as Young explains. The goal of a doctor is to heal the patient, however, there can be environments where the doctor may become narrowly focused on one treatment that he fails to see one that would be more beneficial for the patient. Since no one is . Through the cooperative communication between social workers, behaviorists, as well as patients, the power should instead be shared by the multiple health disciplines instead of owned by one. This allows for multiple perspectives and ideas to be expressed, which can contribute to a more holistic approach to the patient's health.

The final strategy, and one that must be emphasized the most, is to *make care more affordable.* American's pay more for healthcare than anyone else in the world. Universal health insurance coverage is protection against the cost of any unexpected illness, and most developed countries have implemented some version of it. This coverage not only guards individuals against the threat of financial ruin but also serves to minimize the cost that is acquired by everyone else when sick people who are not insured show up in emergency rooms or hospitals. This Universal coverage allows the coverage of preexisting conditions, which prevents certain people from being able to access affordable health care, and keeps the out-of-pocket costs such as copayments and coinsurance reasonable, which prevents bills from going unpaid. Additionally, universal coverage makes it easier for patients to get access and stick with their

preventative care regimen, which gives the ability to avoid repeated emergency room visits and

hospitalizations as well as maintain progress[27] in their treatment (Commonwealth Fund).

An individual's access to health care, as well as the quality of insurance they are able to

afford, is completely determined by their economic class. This is the most morally significant

inequality in America that I see today. Young states that "people are born into a particular class

position, and this accident of birth has enormous consequences for the opportunities and

privileges they have for the rest of their lives" (96). The income bracket that an individual is born

into should not determine the quality (or amount) of health care they are to receive. Studies have

shown that rich Americans are more likely to live longer than those who are in the lower classes;

rich Americans can live up to 15 years longer than their poor counterparts (Dickman et al. 2017).

This is largely due to the for-profit insurance companies. As long as America has this inequality,

Young's language of "accident of birth" will continue to apply.

Economic inequality in the United States has been increasing within the last decade, and

is now among the highest in developed countries (Dickman et al. 2017). While the income gap is

a completely different discussion, it should be widely understood that income should not

predetermine an individual's access to healthcare. Before the Affordable Care Act of 2010 was

passed, 39% of Americans with below-average income reported not seeing a doctor for a medical

problem due to the cost of the visit. Compare that to Canada (7%) and the UK (1%) and one can

see how devastating this avoidance of medical treatment could be for a good large number of

Americans (Dickman et al. 2017). Even after the passing of the ACA, 27 million Americans are

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[27] For example, with Physical Therapy visits for rehabilitation.

still uninsured (down from the 50 million uninsured before ACA), and most of the uninsured are living below the poverty line (Dickman et al. 2017).

Due to being uninsured, these individuals are far less likely to visit a clinic for tests, treatments, and medications because of the cost. This discrepancy proves to be a major problem especially because the prevalence of chronic medical conditions are higher in low-income individuals because they cannot go to the doctor as often as compared to higher income individuals. An example of the problem that chronic medical conditions are higher in lower income people is that individuals who do not have eye care coverage report difficulties in reading or seeing long distances more frequently than those who do have eye care coverage (19 on Dickman).

While there are options provided by the ACA to those below the poverty level (Medicaid), discrimination still exists within the health care system. While Medicaid improves access to care, specialist care can be unobtainable because the program pays low fees to specialist physicians, who thus tend to turn these individuals away. An audit study showed that 76% of orthopedist's offices nationwide refused to offer an appointment to a Medicaid-insured child with a fracture, as compared to the 18% refusal of a child with private insurance (28 on Dickman).

Nearly every chronic condition, from stroke to heart disease and arthritis, follows a pattern of rising prevalence with declining income. In a study done by Oates and colleagues, they found that with the exception of obesity and cancer, for all other chronic health conditions the prevalence of disease was higher among individuals with less than a $25,000 a year income (Oates et al. 2018).

Young attacks this market-driven private firm head-on when she states, "private firms, some of which are larger and more powerful than many states, dominate economic life in contemporary capitalist societies. Their internal organization is typically far less democratic than most governments, and persons whose lives are affected by the policies and actions of such economic institutions often lack the means to confront them" (159). While we can make a substantial amount of progress through political action within healthcare, reform needs to take place within private health companies as well. It is easy to protest publicly for laws to be passed because often citizen's voices are taken into consideration through the process, but private companies are not required to consider public welfare when determining the price of their products and services. This is where I think the disconnect is within healthcare - citizens have no means or medium by which to make reform happen within a private company.

If we were to switch to national healthcare programs, the people's voices would be heard and true reform would be possible. Young states that "more inclusion of and influence for currently under-represented social groups can help a society confront and find some remedies for structural social inequality" (141). This inclusion could possibly help regulate the highly marketed and for-profit disadvantages that the healthcare system currently has. If we take into account as many perspectives as we can, we may be able to bridge the inequality gap, or at least make the gap less enormous. This can be done through processes such as narrative and rhetoric[28]. Perhaps the simple involvement of groups we do not usually include in conversation would help to understand the inequality they face. As I discuss below, we often only see inequality as an

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[28] For Young's definition of narrative and rhetoric, return to Chapter 3.

abstract object, those in power and those who make policies often have never felt inequality in their lives. As long as the healthcare system is privatized, it is hard for it to take into account many perspectives. In order for healthcare to be inclusive, a public system has the most potential for success.

Many developed countries have implemented some form of universal healthcare, so the task therefore is to determine which one works best for the country in question. A country that has the oldest and most successful healthcare system in the world is Germany. Germany has one of the most successful health care systems in the world in terms of quality and cost.

Some 240 insurance providers collectively make up its public option. Together, these non-profit "sickness funds" cover 90 percent of Germans, with the majority of the remaining 10 percent, generally higher income Germans, opting to pay for private health insurance. The average per-capita health care costs for this system are less than half of the cost in the U.S. Germany does not rely on a centralized, Medicare-like health insurance plan, but rather relies on private, non-profit, or for-profit insurers that are tightly regulated to work toward socially desired ends—an option that might have more traction in the U.S. political environment. Premiums are not based on risk and are not affected by a person's marital status, family size, or health. Germans have no deductibles and low co-pays. Doctors are private entrepreneurs and get a fee from insurers for every visit and procedure they perform. However, they are tightly regulated. Groups of office-based physicians in every region negotiate with insurers to arrive at collective annual budgets. Doctors must remain in these budgets, as they do not receive additional funding if they go over. This helps keep health care costs in check and discourages unnecessarily expensive procedures. Government general revenues cover premiums for children, on the

premise that the next generation should be the entire nation's fiscal responsibility, instead of just the responsibility of the parents.

We are told that we must put ourselves into the shoes of others in order to understand what they are going through. Young says that we cannot do this because their shoes simply *aren't our shoes.* In order to understand others, we must listen to them through what she defines as Narrative. On page 77 she says, "in mass society, where knowledge of others may be largely mediated by statistical generalities, there may be little understanding of lived need or interest across groups." I think this quote is very important to the philosophy of health care. We as a society make decisions based on statistics. This is necessary because of how big our country is as well as how many people live in it. However, even though the use of statistics is a powerful tool, we cannot hide behind the numbers. We dehumanize people when we put them as a tally, and I believe that policy makers must constantly be reminded that we are talking about humans in their most vulnerable time of need.

Giving more opportunities for the socially-underrepresented to be heard can put a face to the number and remind those in power that their decisions impact each person differently. We aren't talking about the use of public transportation, travel, or any other measurement of human activity. We are talking about people that have been diagnosed with a life-threatening disease and cannot afford to treat it, so they either put themselves and their family in debt or they don't get treatment at all. The consequences of many policies usually are not life or death, but in the case of health care policy they often are.

Young states that "the primary claims of justice... refer to experiences of structural inequality..." (105). Dickman et al. discusses how, as measured by the Gini coefficient which is a

standard metric of income inequality, the USA is the most unequal of all other countries but

three (Chile, Mexico and Turkey) (Dickman et al. 2017). A striking statistic is the fact that since

1986, the top 1% of households have accumulated nearly half of all new wealth, and now control

as much wealth as the bottom 90% (Dickman et al. 2017). As this economic inequality in the

USA has deepened and developed, so too has the inequality of health. Nearly every chronic

condition, from stroke to heart disease and arthritis, follows a pattern of rising prevalence with

declining income (Dickman et al. 2017). When the health of an individual depends on the

income bracket they are born into, we need to reevaluate how we are providing healthcare for

individuals and the population. Rising costs of healthcare (for both the uninsured and the

insured) reduce disposable incomes, and since those low-income households already have the

least disposable income, it is these households that are disproportionately affected by rising costs

(Dickman et al. 2017). This causes patients to not be able to afford the healthcare they need, and

this results in individuals forgoing medical care altogether.

While the cost of healthcare is known to everyone, often the burden and economic

catastrophe it brings to the disadvantaged is not well known. Young beautifully articulates this

point when she says, "those who lead relatively privileged lives in a segregated society see no

injustice in their situation… [segregation] makes it unnecessary for the privileged to think about

social injustice except in the most abstract terms" (208). As someone who is not from a low-

income household, this quote makes it clear to me that I can only imagine the effects this

healthcare system has for those who are disadvantaged, I can never fully know what it feels like,

and how much of a psychological and economic burden it can be. The only way to completely

understand their perspective and experiences is to have *everyone*, wealthy, middle class, those in

poverty, involved in discussions. Young states that "by communicating with one another their differing perspectives on the social world in which they dwell together, they collectively constitute an enlarged understanding of that world" (112) and that "sharing a perspective, however, gives each an affinity with the other's way of describing what he experiences, an affinity that those differentially situated do not experience." (137) Communication is the solution to bridging the gap between abstract terms and personal understanding.

I have seen this idea in almost every class I have taken as an Honors student at Regis. In Annie Dillard's book, she quotes Rabbi Tarfon; "It is not your responsibility to finish the work of perfecting the world, but you are not free to desist from it either" (35). Therefore, I wrap up this chapter by simply saying that I am not seeking a grand epiphany of how health care should work, rather I am asking that we enter this discussion together and with open minds. Young says that "democratic process is the best means for changing conditions of injustice and promoting justice" (17), and isn't the most basic feature of democracy public discussion?

Chapter 5: Summary

A year and a half of writing later, I sit in my kitchen reflecting upon my work. The premise of my thesis was always something I was deeply passionate about, and now in our recent climate of 2020 the importance of healthcare is incredibly apparent. With the novel coronavirus (SARS-CoV2) wreaking havoc not only in our country but around the globe, revising what I wrote months prior was haunting. The problems in healthcare I addressed in September were the ones people were worrying the most about in March. In this chapter, I will give a final summary of the most important points of my thesis.

Dengue virus is one of the most important diseases of humans in the 21st century. DENV primarily occurs in the tropical countries of the world, in which 2.5 billion people are at risk for the infection. Globalization is facilitating the spread of the virus to new locations and the number of reported cases has increased 15-fold in the last 20 years.

With the assistance of Dr. Gena Nichols, we have found that the knockout of RAB8 and RAB11 proteins via siRNA was effective in decreasing viral release of DENV. This finding is important because it furthers our understanding of the viral mechanism of release and what proteins are needed for its success.

DENV is a significant public health problem, and in order for an effective health response to be strong enough to adequately provide control and protect communities, we need a change in the way our health system works. The real impact of Dengue is during epidemics of the disease, and often medical responses are too little and too late. Through use of Iris Young as well as parameters theorized by the Commonwealth Fund, I explain the ways in which our health

system can improve. Young's ideas about political theory are extremely relevant to health care as well as public health reform.

One of the biggest downfalls of our current health situation is the economic burden it places on its patients. American health practice is a market approach, and while there are some benefits to this type of system, there are numerous disadvantages to this approach. Oftentimes, patients are struggling more with the bills that follow a diagnosis instead of the diagnosis itself. Even if an individual has insurance, many experience financial consequences such as using up most or all of their savings, being unable to pay for necessities, or having to borrow money to get a loan or another mortgage.

These impairments, among others, are a consequence of how our health system operates. There are strategies for developing and delivering a better health care experience that already exist, and they just need to be adopted and applied on a much wider scale. The strategies include: building the capacity to identify and manage the behavioral health needs of patients and their caregivers, assessing and addressing social service needs, making it easier for patients, caregivers, and professionals to work in close coordination with one another, and making care more affordable.

I believe that if we were to switch to a national healthcare program, people's voices would be heard and true reform would be possible. Young states that "more inclusion of and influence for currently under-represented social groups can help a society confront and find some remedies for structural social inequality" (141). This inclusion could possibly help regulate the highly marketed and for-profit disadvantages that the healthcare system currently has. If we take into account as many perspectives as we can, we may be able to bridge the inequality gap, or at

least make the gap less enormous. As long as the healthcare system is privatized, it is hard for it

to take into account many perspectives. In order for healthcare to be inclusive, a public system

has the most potential for success.

While the prevalence of Dengue virus is in the tropics of the world, it is only a matter of

time before the virus's vector (*Aedes aegypti*) is able to migrate further North due to warmer

climates as a result of global warming. Because of this, it is important that we find ways in which

to improve our healthcare system so that it is not overrun by an epidemic/pandemic such as

Dengue like it has been overrun by COVID-19. From one of the most haunting books about viral

infections, *Spillover*, David Quammen states "it's not if, it's when." Dengue isn't waiting around

for our health system to improve before it works through our population, and we shouldn't wait

for Dengue for us to realize our deficits.

Sitting in my kitchen, preparing for a defense that should be in person but is instead

virtual on a video chat platform has made my thesis something that is currently living and

breathing. These concepts I introduce are so apparent to our situation, and they will continue to

increase in importance in the coming years. We can see the burden that infectious disease can

place not only on our medical system but also our economy. Infectious diseases are so

complicated because they do not discriminate against any individual or socioeconomic

background. Infectious disease affects everyone.

COVID-19 has destroyed life as we knew it, and even after we find a way to control it,

there will be another disease lurking in the background ready to emerge and do it all over again.

That disease could very well be Dengue, it could be MERS (Middle East Respiratory Syndrome),

Chikungunya, Ebola, or even an antibiotic-resistant bacterium. The reality is that we are going to

be seeing an increase in the prevalence of many diseases in the world thanks to global warming

(Casadevall, 2020). This trend is not new information. Almost three decades ago, experts warned

us about how climate change could be associated with drastic changes to the epidemiology of

infectious diseases (CDC, 1992). We have driven our climate to the extreme of its tolerance, and

now we must be ready to tackle the side-effects that come with it.

So, the mission is clear: our healthcare system must protect those that are most at risk,

and that is everyone. In order for everyone to be protected, a type of universal coverage is

needed. The challenge in this task is that we have to figure out which system would protect the

most amount of people while also working within our political climate. This is where I think the

power of democratic discussion lies. Through open conversation, we will reach a socially desired

end: improved health for our population.

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