The Cornell Healthcare Review

Sharing Innovations in Medicine

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THE CORNELL HEALTHCARE REVIEW

SHARING INNOVATIONS IN MEDICINE

Dear Readers,

After going completely virtual last semester, we are proud to share our Spring 2021 Edition virtually and in print! With our largest and most diverse staff to date, this edition presents articles on a plethora of topics in healthcare. In addition, we are incredibly excited to share original artwork created by our first-ever cohort of talented artists. We continue to be impressed by our staff members and are so privileged to be able to showcase their work!

This semester, we launched our first ever monthly speaker series. Among many insightful individuals in the healthcare space, we particularly enjoyed hosting our advisor, Professor Sean Nicholson and Jordan Fuller, a Cornell alum in consulting. Our medical school admissions and physician's panel were well attended, and we are so grateful for both the speakers and attendees who supported the rollout of this new event series!

As Cornell has announced plans for an in-person Fall 2021 semester, we are excited to see what the future holds for CHR. We hope to grow our community and continue to share scientific information with all.

Happy Reading!

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Has the COVID-19 Pandemic Ruined a Generation of Children?

by Esha Sheth, Human Development '23

While the COVID-19 pandemic has killed millions and disrupted the mental and physical health of many millions more, people hold on to the hope of an eventual return to a pre-pandemic way of life rather than a 'new normal.' However, for an entire generation of children, the pandemic has the potential to permanently interrupt their social, emotional, and cognitive development. These "Toddlers of COVID-19" have become so accustomed to a lack of social interaction that 2-year old Alice McGraw, upon seeing a family walking towards her family on the street, exclaimed, "Uh oh, people." Another similarly isolated 15-month-old infant, Rhys, began to wave at the babies in a calendar in his room during the course of the pandemic while remaining unable to interact with peers [1]. The lack of peer-to-peer interaction for children in this age range is detrimental to their overall development. As a direct result of the COVID-19 pandemic, many children lack the appropriate pro-social behaviors for their age (e.g. sharing, 'give and take behaviors,' verbal and nonverbal cues), and other essential language and cognitive skills. Many of these fundamental developments reinforce each other as the act of sharing in children has even been found to help "build structure and connectivity in the brain" at this age [1].

While childhood development professionals reassuringly state that the majority of young children will likely still be well-accustomed for their age, this lack of interaction has placed yet another stressor on already-struggling caregivers during the pandemic. Due to a variety of new financial, physical, mental, and childcare-related stressors, many parents lack the patience and care they would have under ordinary circumstances; some have become much more irritable and likely to 'snap' at their children while others have simply had little ability to entertain cognitively stimulating interactions with their children [1]. Furthermore, as Dr. Rashmita Mistry states, the socioemotional and cognitive consequences of lacking these interactions are likely to disproportionately and negatively impact low-income children; while access to early childhood childcare programming has been shown to decrease achievement gaps between high and low-income families, falling behind in this regard due to the pandemic (due to shutdowns in programs or changes in parents' financial status) puts low-income children at a disadvantage when starting school later. Rather than catching up by attending a school with better resources, these children become stuck in a 'cascade,' where being unable to overcome these disadvantages early on in their life makes it much more difficult to compensate for them

Artwork by Keona Moya

later on [2]. As such, several specialists argue against the idea that "children will bounce back" after the pandemic, and that greater investment in the mental, socio-emotional, and academic well-being of children will offset the negative effects of the pandemic, especially for vulnerable populations [3]. Therefore, the pandemic has disrupted the social, emotional, and cognitive development of young children across the globe, with the potential to permanently affecting this psychosocial development and the overall life chances, especially for already-vulnerable populations such as low-income children, children from single-parent families, children with special educational needs, and more [4].

Furthermore, the pandemic-caused lack of peer-peer interactions has grim implications for school-aged children who are more influenced by and rely more on such interactions than extremely young children. Several global studies have focused on the development of school-aged children during the pandemic, as they were kept at home for upwards of a year, with multiple findings. A study from the American Academy of Pediatrics found that 14% of surveyed parents reported worsening behavioral health in their children, which often occurred with worsening mental health in parents, loss of regular childcare, change in insurance coverage status, and worsening food security [5]. Furthermore, a study in Germany found that 71% of children and adolescents were burdened by COVID-19 restrictions, 65% found school to be more exhausting than pre-pandemic, 27% reported more arguments and more argument escalation, and 39% of them experienced deteriorating relationships with friends [6]. Several other disheartening statistics, such as decreasing prosocial behaviors and increasing conduct and peer problems, were only replicated in similar national and international studies [7].

While the impact of the COVID-19 pandemic on people of all ages has been significant, its impact on both extremely young and school-aged children needs to be continually investigated and requires more investment on a national level in order to offset the developmental delays that have already been seen as a result of the pandemic. Unless properly addressed by policy, education, and mental health initiatives, these issues will continue to exist and magnify, especially in vulnerable populations.

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Political Denialism: Why Ignoring COVID-19 is an Economic Privilege

by Theresa Oduol, Interdisciplinary Studies '21

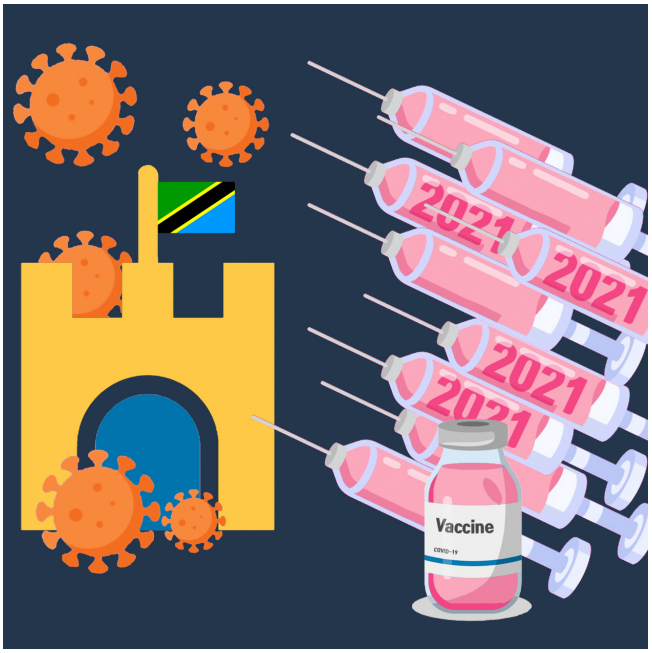
Reflecting on the ways countries have responded to the pandemic, Tanzania emerges as a striking example of using religion to shape the public perception of the virus. According to the latest coronavirus data, Tanzania cases and deaths remain stagnant at 509 and 21, respectively [1]. Although at first glance these numbers appear very impressive compared to the over 500,000 confirmed cases reported from East Africa alone, these numbers were last updated in May 2020 [2]. Ever since, travel restrictions, school closures, and limits on social distancing have been reversed. Former President John Magufuli of Tanzania narrated the evolution of the pandemic through the word of God, citing that the work of citizen prayers and local health officials has eradicated the pandemic.

Most recently, over eight-five clergymen have died from COVID-19 following governmental claims that the virus had been "defeated by prayer" by the "the grace of God" [3]. Other government officials have recommended herbal medicine as a cure for COVID-19. As a result of this misinformation, the World Health Organization (WHO) has urged stricter precautions that continue to be ignored. Furthermore, the lack of accurate data on the pandemic automatically labels Tanzania as a high-risk travel destination by the Center for Disease Control (CDC) and US Embassy.

Tanzania's approach to COVID-19 leaves many vulnerable to the spread heightened by the lack of testing capacity. Moreover, for cases that have been confirmed positive, President Magufuli rejected this truth by blaming faulty testing kits [4]. Furthermore, the Ministry of Health has rejected future shipments of the COVID-19 vaccine, which have been deemed "inappropriate" by officials [4]. This declaration came weeks before we learned of the death of President Magufuli, where it was rumored he passed from COVID-19-related complications on March 17, 2021 [5].

While Tanzania is not the only country that has been vulnerable to the spread of misinformation, it is one of the few countries that has preyed on people's belief systems to counteract the damaging effects a pandemic shutdown could have on its economy. Not only has the government ingrained in its citizens that the virus can be cured through prayer, but it has also questioned the validity of tools to identify its spread. This risk may cause individuals suffering from severe symptoms to exchange medical care for prayer. The death of many clergymen may hopefully reinforce, after the unprecedented death of Magufuli, that people are not immune to the virus and its long-term effects.

Magufuli's pandemic response involved political denialism, which was costly to the lives of others who died from COVID-19. Although Tanzania continues to shine as a specific example of this phenomenon, it is not the only country that has relaxed its rules



Artwork by Suri Gime

on social distancing at a time when it was most crucial.

While much of the world last March shut down its borders, restaurants, and entertainment outings, one country stood out as a model for COVID-19 deniers around the world. Sweden at the time did not implement a lockdown, and schools, stores, and events remained open as usual [6]. The world's stay-at-home order was merely a recommendation for people under 70 and without comorbidities [7]. This was further exacerbated by their inconsistent testing capacity. It was quickly evident that this plan was a setup for disaster with a standardized mortality ratio of 61.1/100,000, which was higher than Italy, Portugal, Germany, and the Netherlands as of August 2020 [8]. Also, Sweden's total deaths in 2020 were the highest the country has reported in the last 150 years [9].

Despite Sweden's mistakes, particularly to its approach toward nursing homes and other long-term healthcare facilities, we must explore the ways Sweden was able to bounce back from its previous shortcomings. Currently, Sweden approximately has a 5,000 seven-day average caseload peaking since January [10]. With accurate data, we can see Sweden's precautions in effect. The underlying question is how has Sweden been able to turn its pandemic response like a light switch shown by its apparent reduction of cases? Can the same be done in Tanzania as we begin to uncover the leadership style of its new president? Given the fragile healthcare system along with the competing priorities that focus on eliminating the incidence of other infectious diseases in Tanzania, coronavirus may become a long-standing issue exacerbated by the low physician per capita ratios outside of capital cities.

However, although Tanzania's example evokes feelings of concern and uncertainty, their approach is not to reflect the actions of the rest of the continent. Existing outbreak prevention infrastructure coupled with optimal climate, and an overall younger population has led Africa to the lowest case mortality ratio worldwide. In fact, Lesotho is one of the few countries that shut down schools before any cases were reported, and this further demonstrates the success of a government's active role in disease prevention [11]. However, this point is not to distract from the idea that ignoring COVID-19 is an economic privilege. The decision of Tanzania and Sweden to soften social distancing at critical moments of the pandemic needlessly ended the lives of others. Unfortunately, while one country's quick reinforcement of social distancing has yielded successful outcomes in preventing disease and death through citizen engagement, the other has to convince its population to erase the narratives of its former president and instill trust in testing, disease surveillance, and vaccines.

The reality of the pandemic demonstrates that coronavirus requires a healthy ecosystem of people and the government to operate harmoniously in defeating COVID-19. This rings true in the United States as contrasting responses by different governors have affected the trajectory of new cases and deaths. Time has revealed that an individualistic mindset toward the pandemic along with misinformation is a setup for disaster. It also has emphasized the government's essential role in setting the tone of the country's response which may foretell future success as the world gradually opens its doors again.

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Issues of Sustainability in the COVID-19 Pandemic

by Clara Hewson, Global and Public Health Sciences '24

As I walked through my hometown, I noticed an increase in litter on the ground. As time passed, observing the usual food wrappers, receipts, and gum that graced the sidewalks for years, I began to see the occasional disposable mask tossed aside carelessly. Returning back to campus, where masks are essential and required, the presence of this type of pollution is even more evident. With the onset of the pandemic, all efforts have turned to prevent the spread of COVID-19 with a call to social distance, wear face coverings, and practice more sanitary habits. At the forefront of medical care, doctors and other essential healthcare workers take extra precautions in the interest of treating patients while also avoiding infection. Within these health care settings, personal protective equipment (PPE) functions as a key factor in controlling the disease. Although the manufacturing and production of PPE have increased significantly, their lifespan has remained limited, with most of the PPE taking the form of single-use products. Moreover, the manner in which people are disposing of them presents a major problem for the environment. This, along with the increased output of medical waste, results in an unforeseeable consequence of the pandemic: contribution to waste pollution which threatens the health of our planet.

Even before the pandemic, the world already struggled with waste management. However, with the significant increase in hospitalizations and families working from home, this issue has worsened [1]. At the height of the outbreak, the generation of medical waste climbed at an alarming rate. In Wuhan, China, the epicenter of primary infections, hospitals, and other medical centers were generating around 240 metric tons of waste per day [2]. In comparison to the output before, this is almost 190 tons more [1]. Similar issues are evident in other cities around the world, such as Manila, Hanoi, and Bangkok, demonstrating the widespread reach of waste pollution during the pandemic [1]. Just as the pandemic affects numerous countries, so does pollution. Thus, it is not the fault of one country; rather, it is the responsibility of the world.

It is easy to look at the numbers in terms of overall production and write it off as a problem for large entities such as the government or hospitals. However, individuals are at the root of this issue as well. We choose convenience over sustainability, deciding to purchase disposable masks instead of investing in reusable ones. The market for disposable masks has a compound growth rate of 53%, demonstrating the incredible demand for expendable products [3]. The significant increase in manufacturing has been identified in connection to the pandemic, which translates to more products being used and, inevitably, more frequent improper disposal. When the masks are not discarded correctly, they inflict damage on the environment. In Hong Kong specifically, masks clutter the beaches and float into the water, acting as a hazard to wildlife [4]. Surgical masks like these are made out of polypropylene, a thermoplastic polymer that can take up to 20-30 years to completely degrade [5]. With such a long lifespan, these masks can critically harm natural ecosystems for multiple decades. For marine life, synthetic polymers can become "marine debris", which can lead to interactions resulting in smothering, ingestion, or entanglement [6].

What can be done to combat these issues of waste disposal and sustainability? Primarily, medical waste needs to be thoroughly treated and contained so that it does not cause further contamination when it is discharged [7]. Governments should allocate resources so that this process is properly managed, as well as promote information on proper disposal for people to utilize [7]. Educating constituents enables them to self-regulate their environmental impact. In terms of single-use products, those with the liberty and ability to choose should opt for purchasing reusable masks or other face coverings. However, there are cases where people either are required to use these surgical masks or are unable to obtain other options. As of now, there are few opportunities to recycle them due to their composition of a highly unsustainable polymer. What's more, is that single-use masks are also just one small part of products containing polypropylene. To confront this, more methods for polypropylene recycling need to be developed. Simultaneously, existing methods should be further advertised in the interest of reusing materials and decreasing their contributions to landfills. The pandemic has already impacted humanity, let us not allow it to damage the environment too.

Artwork by Suri Gime

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Gambling at the Grocery Store: Risk Assessment During COVID-19

by Tracy Lihui Zhang, Biochemistry & Philosophy '23

I'll just pull out! Just one more round of poker… I don't really like him but he's so persistent, fine... we can get married.

Human decision-making is often not as secure and foolproof as we hope it to be. Immediate and even anticipated emotions, hormone levels, stress, and social pressure can all impact our ability to make sound decisions [1]. We are constantly weighing risks and forecasting potential outcomes, and our imperfect selves are often afflicted with biases [2]. In the wake of the Coronavirus pandemic and over half a million COVID-19 deaths in the United States alone, we have seen a flurry of perplexing behaviors exhibited by even the most trusted figures in society: persistent partying, wreckless travel to populated destinations for pleasure, and slandering of scientists and health officials, to provide a few examples.

From a disordered federal response to the crisis to the impacts of the mental strains of isolation and fear, there is a myriad of possible factors driving these sense-defying behaviors. This phenomenon has drawn researchers from nearly every discipline, all trying to understand this pattern and to construct public health policies that anticipate these behavioral tendencies.

A study tracking human mobility during the COVID-19 pandemic showed that there was a significant decline in human mobility after the declaration of COVID-19 as a pandemic as well as when the first coronavirus death was reported in a region [3]. Similarly, in an observational study of nearly 10,000 shoppers in the US, there was increased compliance in adherence to mask-wearing and social distancing after a mandate. But interestingly, gender, age, and location were factors that determined whether a person voluntarily wore a mask (with females and the elderly more likely to do so) [4]. In another 4,000 person study, the young, educated, and those unconcerned with being infected were the most resistant to wearing a mask [5]. For the younger members of society, a study of kindergarteners showed that a mother's educational background and the preschooler's place of residence were correlated with mask-wearing while gender, grades, the mother's education, and the father's occupation correlated with handwashing [6]. These trends indicate that mask-wearing, hand washing, and adherence to social distancing are deeply social behaviors.

The particular invisibility of this virus, namely where the sick lay isolated inwards shut off to the public, and thus suffer alone, removes the imminence of this threat. With an unclear central public health message, the stresses of uncertainty and the ever-present sensationalized media feed skew the perception of risk. And indeed, stay-at-home policies and social distancing behavior precipitated depression, anxiety disorders, intrusive thoughts, insomnia, and acute stress for many [7].

At a distance from the frontline workers working grueling hours at understaffed and under-resourced hospitals, the logical motivation to follow basic public health measures can begin to dissipate. Add to that a political campaign to politicize, delegitimize, and defame these guidelines or a peer group remissive and out of touch with the loss and grief of so many and we can easily be swayed to behave in dangerous ways.

However, establishing protective norms like mask-wearing or handwashing does not need to be coercive, even to the most resistant offenders. Yale researchers presented evidence from the US national response to conserve food during WWII that health regulations can be followed without coercion through good leadership and the provision of information that productively instills powerful personal attitudes towards a societal threat [8].

Humanizing the lives lost to the virus and the soldiering healthcare workers can reinforce positive social attitudes towards following proper mask-wearing measures. Throughout the pandemic, ICU nurses have not only been quitting in significant numbers but have been increasingly diagnosed with PTSD after experiencing such magnitudes of death and suffering within hospital walls [9]. Not only did thousands of nurses and doctors come out of retirement to support overfilled hospitals, but 3,600 healthcare workers died during the pandemic [10]. The stark contrast of this reality to politicians completely rolling back mask mandates and reopening business to 100% capacity [11] in a state with a severe nurse shortage [12] does not create an environment where public health measures can be easily respected.

As more and more people begin to get vaccinated and our sense of normality returns, it is important that we remember the shortcomings of our societal response to this pandemic and the greater depth of tragedy it may have contributed to. Research has indicated that adherence to public health measures depends on our collective cooperation. Our behaviors can influence those of others. As both Spiderman and the French philosopher, Voltaire once said, with great power comes great responsibility. And indeed, it seems that with a greater understanding of the power of our individual actions to influence those around us comes to a great responsibility.

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Artwork by Kaylah Nicholson

Retail Health: Coming to a Neighborhood Near You

by Jake Derderian, Nutritional Sciences '21

Most people go to a CVS or Walgreens to grab a quick snack, buy laundry detergent, or pick up a prescription and some cold medicine. Well, what if I told you that pretty soon you could be going there to get your blood glucose levels checked or flu symptoms examined? With a healthcare industry that is hyper-focused on consumer convenience, this may very well be the case in the near future. Retail health clinics are popping up across the country at pharmacies and big-box stores, with CVS, Walgreens, and Walmart being the most popular brands trying to get into primary and acute healthcare. Before examining the specifics of each clinic and the limitations of this business model, it is important to understand what exactly these health clinics are.

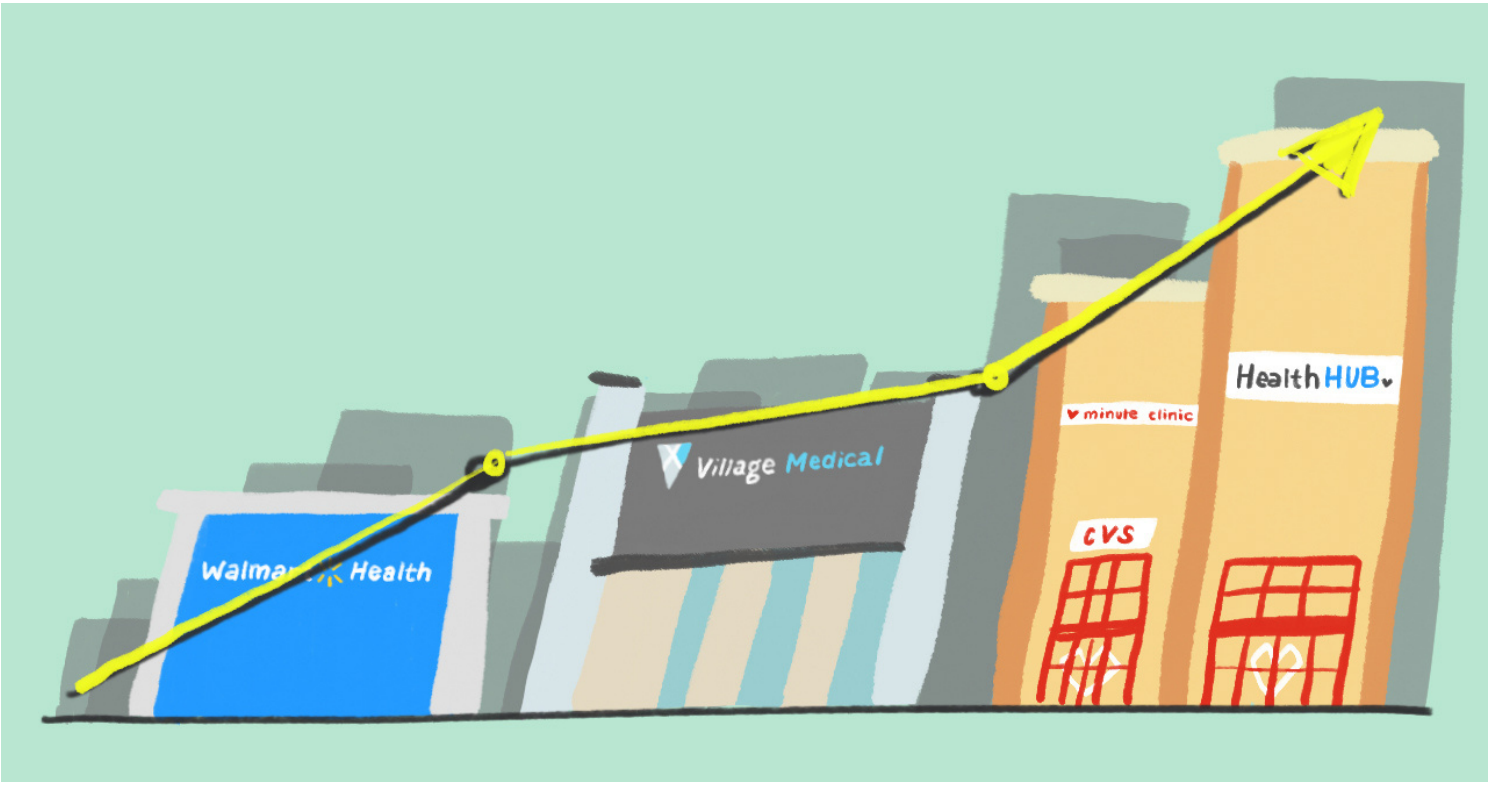
As the name indicates, retail health clinics are health centers located directly in retail stores. They are designed to provide a convenient and cost-effective location for patients to receive acute treatment or preventive services. While the three previously mentioned companies differ slightly in the specific services offered, retail health clinics are generally staffed by nurses or nurse practitioners and are designed to treat minor issues including flu-like symptoms, rashes, scrapes, sprains, bronchitis, etc. The clinics do not require an appointment and offer fixed prices for all their services that can be found online, features that make the clinics more attractive than seeing a primary care physician or waiting hours at an emergency department [1]. With a basic understanding of what retail health clinics are, let's examine the nuances between those located in CVS, Walgreens, and Walmart.

CVS Health MinuteClinics and HealthHUBS

Upon its acquisition of major health insurer Aetna, CVS Health proclaimed its goal to transform the way consumers experience healthcare [2]. The company has aimed to do so through two different types of retail clinics: MinuteClinics and HealthHUBS. The original MinuteClinics, located in regular CVS stores and some Targets, offer treatments for several minor health issues, such as strep throat and shingles, in addition to providing mental health counseling, smoking cessation programs, and weight-loss plans. The HealthHUBS is an expansion from the MinuteClinics and is more specialized to focus on treating chronic conditions such as diabetes, asthma, and high cholesterol. In addition to offering sleep apnea assessments and blood draws, the HealthHUBS house an in-store dietitian and wellness rooms for yoga classes [3]. Despite the impediment on construction due to COVID-19, CVS is still on track to meet its goal of having 1,500 HealthHUBS operating by the end of 2021 [4].

Village Medical at Walgreens

Walgreens Boots Alliance has entered the retail health world in a slightly different way than its competitor CVS, partnering with medical services provider VillageMD as opposed to running the clinics itself. The VillageMD clinics also differ in how they are staffed, with primary care physicians working in tandem with pharmacists to find the best treatment path for patients. The services offered are similar to those provided at HealthHUBS, including chronic disease management, annual wellness checkups, women's health services, and vaccinations. The clinics



Artwork by Alexandra Jin

also offer several diagnostic screenings, including bloodwork, urinalysis, and EKGs. Other unique offerings are around-the-clock telehealth appointments and at-home doctor visits designed for the elderly or immunocompromised. By 2025, Walgreens plans to open up to 700 clinics across 30 U.S. markets, staffed by primary physicians and potentially including nurses, social workers, and therapists [5].

Walmart Health

Walmart is perhaps the most surprising of the three organizations to get into the retail health space given its history as perhaps the most established big-box store in history. In Fall 2019, the retailer unveiled its first Walmart Health clinics in Dallas and Georgia, located adjacent to Walmart Supercenters with a separate entrance. The clinics are similar to Walgreens' in that they are led by doctors as opposed to the nurse practitioner model of CVS' clinics. The clinics offer a variety of services ranging from traditional primary care to audiology, optometry, and dental exams [6]. To date, Walmart has twenty operating clinics and plans to open up more than fifteen by the end of 2021, although their commitment to this plan has been questioned due to an Insider report in February 2021 stating the organization is slowing its rollout [7].

Looking Ahead and Limitations

While it is evident that retail health clinics are more convenient and affordable than other options, there are some drawbacks that may limit their future potential. Most notably, it is easy for care to become fragmented when patients have so many access points to get treated. Most of the retail clinics do not have a standard system for sharing records with other providers, potentially making it difficult for primary care physicians to understand what remedies their patient has already tried [8]. Additionally, a 2016 study found that the convenience of the clinics may actually increase total costs since patients are more likely to utilize care that they otherwise would not have. Only 42% of subjects used the clinics as a substitute for visiting their doctor or a hospital, with those who visited the clinic instead of staying home creating an average increase of $35 per visit in healthcare spending [9].

While consumers may be elated over the convenience of going to their local Walmart or CVS to get an ear infection treated or have their blood pressure checked, it is important that patients are educated on when to use these clinics so as to not unnecessarily increase healthcare spending.

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How the Biden Administration Plans to Improve the Affordable Care Act

by Vincent Zhang, Health Care Policy '23

Compared to other high-income countries, the United States has repeatedly ranked low in every metric of healthcare- from access and quality to cost. Over 10 years ago, President Barack Obama alongside Vice President Joe Biden signed the Affordable Care Act (ACA) into action to combat some of these issues. After examining the effects of the ACA on American families and their overall health, it is apparent that there were both positive and negative attributes associated with the ACA-- increasing access while increasing costs to others. Now with the Biden administration, we will see how healthcare under the ACA will expand and change in response to the lessons that we have learned over the past 10 years.

By examining metrics for healthcare access, we can analyze the effects of the ACA from 2010 to recently. The ACA was able to expand medical coverage to over 20 million additional Americans in 2016, which decreased the number of uninsured from 48.6 million in 2010 to 28.6 million in 2016 [1-3]. By raising federal poverty rates to 133% of normal rates, Medicaid has been expanded to almost 12 million new Americans in 2019 since its signing in 2010 [4]. Along with government subsidies provided as premium tax credits for families up to 400% of federal poverty levels, insurance coverage increased dramatically for many Americans. Additionally, the ACA was able to establish the Healthcare Marketplace for Americans to search through private insurances rated from Bronze to Platinum. These "metal types" for health insurance categorize these plans based on deductibles, premiums, co-payments and other costs. Higher rated plans have more expensive monthly payments, but increased coverage and access to physicians and medical care.

In 2017, when the Trump administration transitioned into office, some changes were made to dilute the effects of the ACA. For example, the individual mandate, which fined individuals for not having insurance, was brought to $0. Additionally, the Trump administration brought certain legislation within the ACA to the Supreme Court in respect to the constitutionality of Congress to tax individuals without insurance. Preliminary studies have shown that the removal of the individual mandate will decentivize healthy, young workers from engaging with insurance [5]. This finding decreases the chances of healthy Americans purchasing preventive care, while increasing their chances of expensive emergency care [5].

Furthermore, health insurance costs would rise as more sicker Americans are burdened with higher premiums. Overall, the actions of the Trump administration allowed young and healthy Americans to spend less on medical insurance while raising costs to those who have pre-existing conditions. However, although these changes were seen, the majority of the infrastructure created during the Obama administration remained during the Trump presidency- including the Healthcare Market, increased Medicaid coverage and legislation preventing insurances from discriminating against those with pre-existing conditions.

During Biden's first year in office, multiple changes have already been proposed to the pre-existing ACA. One of the biggest changes that Biden has proposed is the introduction of a "Medicare-like" public option for general American citizens who are not eligible for Medicare or Medicaid [6]. According to a 2020 poll conducted by Kaiser Family Foundation, 68% of American adults support a public healthcare option [7]. A public option would most likely have lower premium costs, giving the federal government more negotiating prices to lower provider payment rates from private insurers. However, it is important to note the lobbying power of both the pharmaceutical industry and health insurance companies within a bipartisan Congress, and the lack of support President Biden would have for this public option.

It is unclear how healthcare plans will look under Biden's administration because of recent COVID-19 stimulus packages and aid proposals. In particular, the $1.9 trillion stimulus package included money for mental health programs, subsidizing Medicaid eligibility criteria for those who are uninsured or on the individual market, supporting COVID-19 vaccination and testing programs and more [8]. Under the Biden campaign, cutting costs and expanding costs were at the core of his political agenda on the topic of healthcare [8]. For example, Biden is targeting subsidies to "Gold" health plans under the ACA marketplace exchange, thereby reducing premium costs. For families who are under 400% of the federal poverty line, Biden plans on capping the amount Americans spend on health insurance to 8.5% of their income [9]. Regarding pharmaceuticals, Biden proposes to reduce pharmaceutical drug prices by enforcing a rebate on companies that charge drug prices higher than the rate of inflation [10]. These proposals all seem to encompass Biden's overall plan to decrease costs of healthcare spending for Americans.

These proposals also seem to align with strengthening the legislation of the ACA to expand coverage. It is important to note, however, that during the Obama administration, that costs generally increased for the general American population, which was an unintended consequence. This is evident through deductible increases from $217 in 2011 for the average enrollee in the individual market, to $515 in 2019, which is a 137% increase [11]. With COVID-19 stimulus packages and vaccination programs continuing to impact the general public, it is unclear whether these health insurance programs promised by Biden during his campaign are feasible to pass under Congress in the coming months. However, through the stimulus package passed by Biden, it is clear that there is a considerable movement towards expanding Medicaid and increasing government subsidies to increase healthcare access within the ACA.

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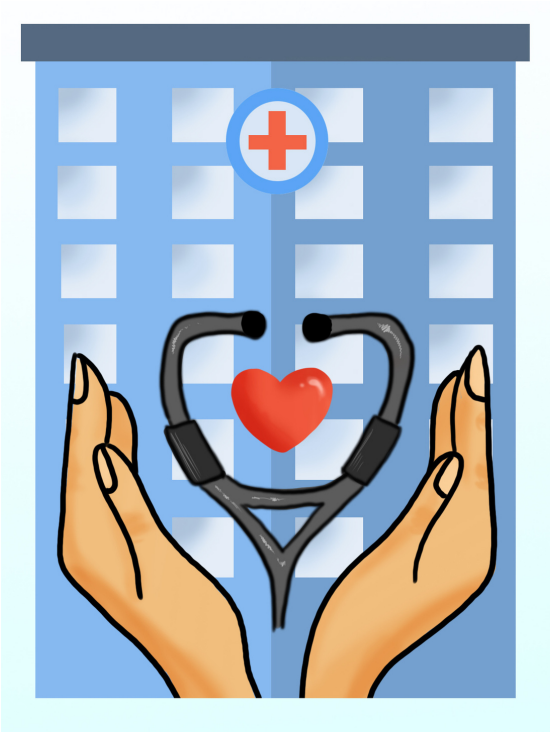
Artwork by Suri Gime

The Problematic Irony of Hospitals Lacking in Hospitality

by Mielle Emouna, Hotel Administration '24

The ironic quandary of hospitals lacking in providing adequate hospitality is a vital problem that all healthcare facilities should alleviate, both to improve the patients' environment and improve medical outcomes. Hospitals should instill a comprehensive approach that includes the patient and family alike within a protocol that allows them to feel less stressed and promote positive patient health outcomes.



Artwork by Aleena Li

Having reliable hospital employees is parallel to the significant impact that hotel employees have on a guest's stay. Throughout a patient's visit to the hospital, or any healthcare facility for that matter, every interaction that the patient and family members endure with a staff member has the ability to be a life-altering interaction and positively change the course of the patient's stay. Gerard van Grinsven, president and CEO of Henry Ford West Bloomfield Hospital in West Bloomfield, Michigan, described patient satisfaction as "a result of a philosophy that is embedded in the culture—a philosophy that also extends to employee retention and growth" [1]. Therefore, hospitals must strive to hire a workforce of doctors, nurses, and other facilitators of patient care that align with their culture's goals. Hospitals should consider the use of the Enneagram, a model of nine different personality traits that can be used as a motivational tool to recruit and retain employees [2]. Once the hospital's hiring team is able to recognize a potential employee's Enneagram type, they can extensively analyze how this employee will work by understanding their tendencies. For example, employees who are "Ones" are usually goal-oriented instead of process-oriented and need clear communication for their role expectations, indicating that they would feel comfortable in "Total Quality Management Environments" [3]. Hence, they may gravitate towards roles with a central control aspect. The ability for hospitals to determine which employees should be in more control-centered leadership positions enables them to recruit the proper amount of employees they need for control-centered roles, thereby improving predictions of employee success and further increasing the ability for employee retention to occur, since those employees will be successful and personally satisfied in those roles.

An integral part of establishing a powerful workforce includes strong communication channels within the organization. In a hospital, there are many tiers and departments that have ties to patients and their families. Typically, there are healthcare teams from multiple departments working together to aid the patient back to good health as well as social workers, environmental workers, food service workers, and administrative employees. A multi-level hierarchy of employees necessitates employees understanding their roles and responsibilities and how they uniquely fit into the overall purpose of the organization [2]. For instance, nurses must understand their specific duties in aiding the patient and communicate other duties that need to be fulfilled to the correct department. An overrun and frustrated staff diminishes the hospital's ability to leave patients with a good experience and, therefore, prompt and successful medical outcomes.

The Ritz-Carlton hotel chain implements the phrase "ladies and gentlemen serving ladies and gentlemen" to demonstrate how highly they treat their employees, which they hope will transfer to the same level of service and respect while interacting with guests. In a hospital setting, support staff generally spend more time with patients and families than the clinical staff, indicating how vital it is for patients and families to have a good experience with the support staff [1]. The HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) is the first national, government-mandated survey that displays a patient's opinions and criticisms of hospital care. The survey contains a total of 29 questions, in which 19 of them ask about the patient's communication experiences with the various staff members that they interacted with during their visit [4]. The widespread installation of hospitable actions has the power to substantially increase hospitals' HCAHPS ratings, ultimately promoting improvements in the medical outcomes of patients, since increased, effective communication between patients and providers likely puts patients more at ease, enabling them to completely focus on improving their health and not on any external factors.

Throughout a patient's stay at the hospital, they, along with family members, are exposed to many stressful situations pertaining to medical decisions. Stress can be defined as "any intrinsic or extrinsic stimulus that evokes a biological response" [5]. Chronic stress has detrimental effects on the nervous, endocrine, cardiovascular, gastrointestinal systems [5]. Hospitals should strive to eliminate any more external stressors to patients and

family members, enabling them to completely divert their time and attention to the patient's needs. Prominent patient and caregiver stressors include pain-management interventions relating to specific diagnoses, quality of sleep, patient-provider communication, and having family members included in medical care plan discussions [6]. Therefore, the patient can feel less stressed and anxious and focus their mental energy on improving their medical health, while simultaneously allowing the hospital to perpetuate an improvement in overall quality of care.

The creation of a powerful workforce has the ability to drastically improve the lives of patients and caregivers. As we reevaluate our modern definition of healthcare, the notion of mitigating hospitals lacking hospitality is an integral part of improving patient experiences, and, ultimately, medical outcomes.

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Legalization and Benefits of Medical Marijuana

by Ngoc Truong, Biological Sciences '24

"Marijuana" is often used interchangeably with "cannabis," but the two are not necessarily the same. The latter refers to the plant, Cannabis sativa, from which marijuana is derived. Marijuana refers to parts of the plant that hold substantial amounts of tetrahydrocannabinol (THC), which is responsible for the "high" (altered mental state). The use of cannabis, specifically herbal marijuana, comes along with negative stigma throughout the world. For medicinal purposes and recreational use, general apprehensiveness about opportunities for potential abuse persists despite the proliferation of scientific studies and technological discoveries in support of cannabis' medical benefits. The aspect of Jekyll versus Hyde when talking about benefit vs. abuse has also impeded the legalization of marijuana in many places for all uses. However, as a silver lining for marijuana supporters, many medical professionals, researchers, and the general population support the drug's medicinal assets.

Artwork by Aleena Li

THC and cannabidiol (CBD) are the two main cannabinoids, or substances in the plant that induces euphoria, increased appetite, and dry mouth, among other effects [1]. The FDA has yet to approve the cannabis plant for medical use but has approved multiple drugs that contain cannabinoids, including Epidiolex and Marinol. Epidiolex treats seizures associated with two forms of epilepsy, Lennox-Gastaut syndrome and Dravet syndrome. Marinol, which contains synthetic THC, treats nausea and vomiting induced by cancer chemotherapy. As marijuana has proven beneficial for ameliorating a wide variety of symptoms, research on its application for treating other conditions is necessary and expanding.

In a 2015 study conducted by the PEW Research Center, among the 53% of participants in support of marijuana legalization, 41% cited its medicinal benefits as a reason for legalization [2]. First, cannabinoids, a type of chemical in herbal marijuana, are suitable alternatives to antiemetics for patients experiencing chemotherapy-induced nausea and vomiting [3]. Moreover, in a prospective observational study about medical cannabis for patients' chronic pain, significant improvements in the severity and interference of pain were seen in participants as early as one month after starting treatment and were maintained over the course of the 12-month observation period (mean BPI-S score was 5.58 ± 1.53 at baseline, indicating moderate to severe pain, and 3.49 ± 2.17 at M12, indicating mild to moderate pain) [4]. Lastly, cannabis administration for patients with multiple sclerosis (MS) is associated with decreased symptom severity and may have a positive impact on the cytokine and clinical profiles in cases [5].

Legalization, or lack-there-of, of medical marijuana, varies between states. As of November 2020, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and 36 states in the U.S. have passed legalization for the decriminalization of medical marijuana. 11 states legalized the use of "low THC, high cannabidiol (CBD)" products in medical situations [6]. All legalized use is tightly regulated to avoid abuse of the Schedule 1 substance, therefore lowering the risks for drug abuse. Evidenced in part by the recent legalization of marijuana for recreational purposes in New York, regulations have and will likely become more progressive as research continues to back its multifaceted functions in medicine.

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The Failure of Our Healthcare Supply Chain

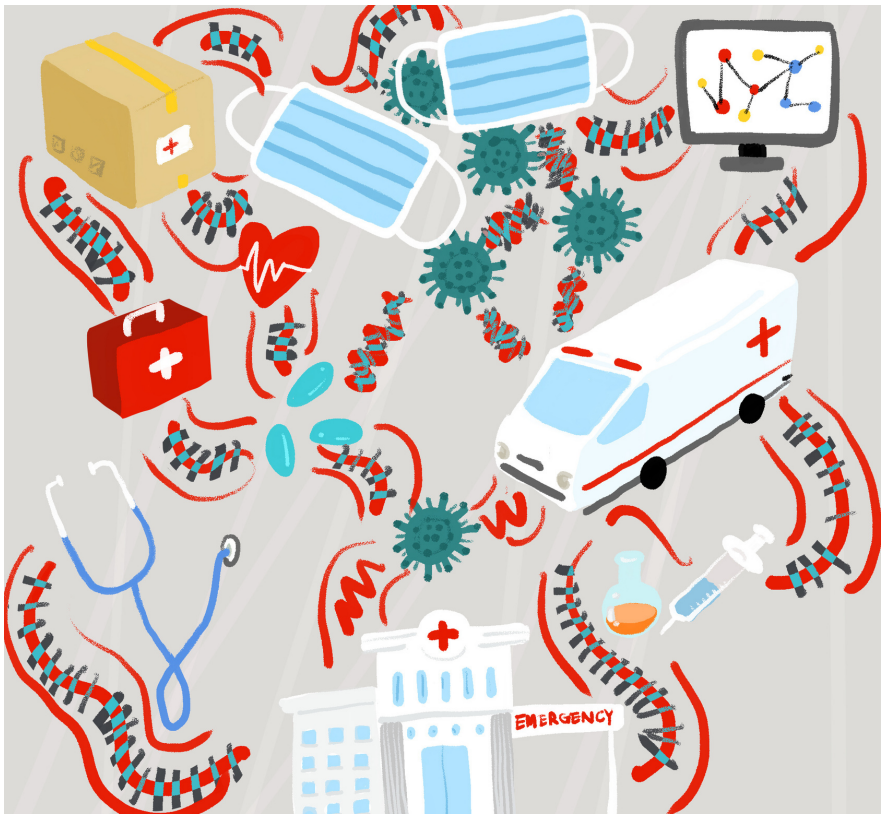
by Amrit Hingorani, Biological Sciences & Nutritional Sciences '20

Our entire healthcare system and thus all of our own health and well-being depends on the oft-overlooked supply chain that feeds our healthcare providers. Healthcare supply chain management is the field that deals with the regulation of the flow of medical goods and services from manufacturer to patient. In the healthcare realm, managing a supply chain tends to be a very complex and fragmented process involving various different healthcare departments and suppliers all vying for the best possible deal. Yet, a dependable and reliable supply chain is of utmost importance because people's lives are on the line. In the healthcare industry, timing is everything and lack of supplies or poor timing of their arrival can cause many preventable deaths [1].

Recently, with the COVID-19 pandemic, we saw a major breakdown in the U.S. healthcare supply chain. Severe shortages of essential frontline medical devices and personal protective equipment (PPE) brought fundamental concerns regarding the sustainability of the healthcare supply chain to the forefront of public health discussions. Early in the pandemic, Asian factories shut down, halting exports of medical supplies to the US [2]. Government stockpiles were already depleted from the 2009 H1N1 flu outbreak a decade earlier and with no way to rapidly restock, shortages of necessary equipment resulted [3]. The federal government advised people not to wear masks to save the supply for healthcare workers. Subsequently, counterfeits and low-quality masks and other equipment flooded the market [4]. Testing fell behind early and took very long to recover, especially once cheap, disposable swabs, made mostly in Italy, became rarer and harder to obtain [2]. As the fragile links between the manufacturers overseas and our frontline healthcare workers collapsed, our system began to unravel and needless COVID-related deaths resulted. Resultantly, shortages in masks, gloves, gowns, shields, testing kits and other medical supplies cost countless lives that could have been saved with careful planning and better logistics.

Not only were stockpiles not kept fully stocked and available sources of supplies dwindling rapidly, but also there was no real contingency plan or organized response throughout our healthcare system. State and federal government contracts outbid each other for various supplies and many states turned to questionable supply providers, often not receiving supplies even after paying a great deal for them. It is easy to say that having a contingency plan is the solution, but streamlining the response to health crises such as a pandemic on a national level would have gone a long way in improving the U.S.' COVID response.

There have been a wide variety of strategies proposed to improve the U.S. healthcare supply chain; one of which is to promote U.S. markets by amending policies to help local manufacturers. This would lessen the reliance on imports from other countries and ensure more readily available supplies. In 2020, almost all medical protection supplies in the U.S. were made in other countries, and when global supply chains fractured, U.S. manufacturers were left
to try to fill the gaping supply holes and switch from manufacturing other products to medically relevant ones. The



Artwork by Alexandra Jin

Trump administration invoked the Defense Production Act (DPA) to compel some companies, such as 3M, General Motors, and General Electric, to refit their factories and start making supplies in the fight against COVID [5].

In a similar vein, another way to incentivize the production of more PPE is through expanding the Buy America rules. This would look past what is needed solely for infrastructure and national defense and allow for purchases to be made for departments such as the Department of Health and Human Services. In response to the poor coordination in the COVID response efforts and this lack of domestic production of PPE and other necessary supplies, President Biden passed two executive orders in his first week in office. These systematized the federal government's management and coordination of the COVID recovery efforts, including through re-evaluating the Strategic National Stockpile and establishing a better framework for the use of the DPA [6]. Both of these orders have allowed Pfizer and Moderna to have better access to raw materials, allowing vaccine production and distribution to surpass expectations [6]. Importantly, these executive orders set a better framework to handle future health challenges that may emerge.

Some success in improving the healthcare supply chain has also been found through cost transparency and increased access to data for all supply chain participants. This would allow healthcare organizations to track and manage inventory more efficiently and allow for more informed purchasing contracts to be negotiated. This results in improved decision-making and significant cost savings throughout the healthcare sphere [7].

Another strategy for improving the healthcare supply chain would be to increase cooperation among hospital departments and hospitals within linked systems. Getting these entities on the same page would allow for a reduction in costs and boost the performance of the system as a whole. Physicians and clinical staff and the healthcare providers directly using the supplies should be involved in decision making and supply chain solutions they know they can stick to. This would involve larger cooperation among clinicians and various hospital administration branches [7].

In the near future, we are likely to see many more major health crises and pandemics as zoonotic transmission increases and globalization surges. We need to improve our healthcare supply chain before the next crisis catches us off guard once again and we lose numerous lives because of it.

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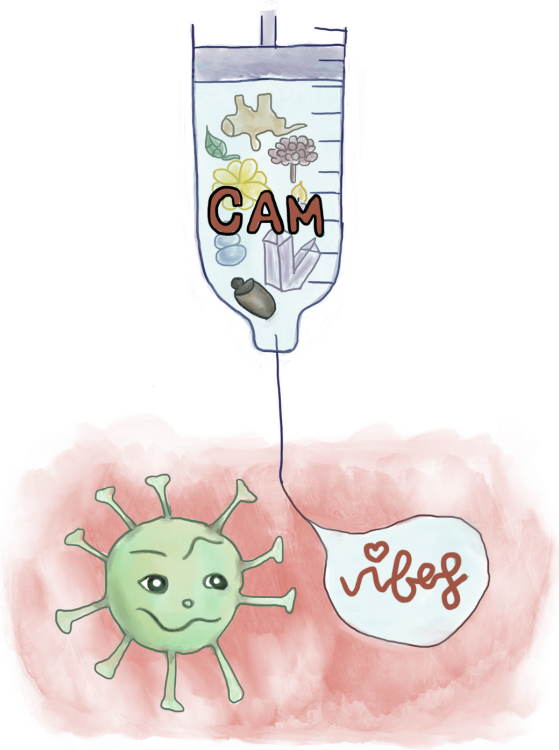
Uncertainty and Placebos Galore: Complementary and Alternative Medicine

by Christine Wu, Human Biology, Health and Society '23

What is medicine? Perhaps you first visualize images of digital prescriptions at the doctor's office or bottles of pharmacy medications. Maybe you think of physicians in their white coats or surgeons in their blue scrubs — ultimately, it's likely that you associate the term "medicine" with conventional Western medicine.

In the U.S., we are predominantly exposed to Western medicine. However, another form of medicine — complementary and alternative medicine (CAM) — exists under the radar. Complementary medicine is defined as the usage of unconventional medicine in conjunction with mainstream medicine. On the other hand, alternative medicine is defined as the usage of unconventional medicine to replace mainstream medicine [1]. CAM approaches medicine by viewing patients holistically. While CAM proposes that mental, social, physical and spiritual health are interconnected, Western medicine views the body in separate parts [2]. As physicians of traditional Western medicine focus on compartmentalized body systems in order to treat a patient, CAM emphasizes natural treatment methods that aim to manipulate the general "energy fields" of the body. These methods encompass herbal medicine, chiropractic medicine, traditional Chinese medicine, Ayurvedic medicine, and more [3]. While CAM is rarely talked about in mainstream medicine, it influences both the U.S. healthcare system and its consumers.



Artwork by Ronya Strom

The CAM industry has held a steady presence in the U.S. healthcare system for many years. The most recent National Health Interview Survey estimated that in 2007, 35.5% of adults used some form of CAM in the U.S. and 33.2% in 2012 [4]. Its considerable usage in the U.S. can also be evidenced by how the general public spends a sizable amount of money on CAM-based products. In 2016, Americans were said to spend around $30.1 billion on CAM procedures; $14.7 billion of that went to CAM practitioner visits such as acupuncturists, naturopaths and hypnotists, while $12.8 billion went to natural product supplements [5]. These costs are all out-of-pocket, indicating that there is significant demand for CAM products. The CAM industry is not nearly as widely discussed as dominant conventional Western medicine, but it is crucial to address its implications on general public health. Despite high demand, the scientific legitimacy behind various CAM products remains dangerously unclear, possibly due to the lack of scientifically sound experimental trials for these products. Some studies may not have control groups for the "placebo effect," which can result in a false positive when determining the efficacy of a drug. Some studies may not be randomized, and some may have too small a sample pool to come to reliable conclusions [6]. As such, it is incredibly difficult to find reliable evidence for various CAM treatments, and current scientific literature often reflects inconclusive evidence for treatment efficacy. For instance, therapies such as yoga and meditation have generally been deemed safe by scientific consensus, despite a lack of clarity regarding efficacy in alleviating depression or anxiety [7, 8]. The effects of acupuncture are conflicting; a 2007 Cochrane systematic review was conducted on 32 papers, and only two were found to support the efficacy of acupuncture for nausea and headaches [9]. Another 2010 Cochrane review noted small benefits of acupuncture on osteoarthritis, yet clarified that the benefits could very possibly be due to a placebo effect [10]. Additionally, St. John's Wort is an herbal remedy that is categorized as a dietary supplement by the FDA — it is thought to treat depression and other mental disorders, but some trials have failed to observe its effect over placebo [11].

Being that CAM treatments often consist of dietary supplements and methods that target a patient's "spiritual energy," the very nature of CAM makes it susceptible to the placebo effect. CAM's naturalistic approach to medicine may appeal to the public with its "healing effect," which feels more accessible than a doctor's office and hospital setting. It is imperative to approach with caution, however, as the lack of sound scientific information supporting CAM therapies can make their efficacy unclear to consumers. In one particular instance, Hyland's, the nation's largest homeopathic business, sold teething tablets for toddlers, claiming "safe, effective, and natural health solutions." These teething tablets were discovered to contain an herb called "deadly

nightshade," and caused more than 370 children to experience horrific respiratory effects over a period of 10 years [12]. The manufacturers claimed that the toxic belladonna compound would help reduce the pain associated with teething, although its effects were unclear. The tablets were not strictly regulated by the FDA and were considered as over-the-counter medications. This resulted in dire consequences for the toddlers, such as seizures and infant deaths.

Although the topic rarely appears when we initiate conversations about medicine, it is important for us to be aware of the potential consequences of promoting CAM to consumers. The field of complementary and alternative medicine is one that is shrouded by both uncertainty and hope, and a tricky source of controversy among patients, researchers, and physicians alike. From the challenges of controlling for placebo in CAM trials to the subsequent obscure literature that exists to support CAM treatment, one should approach these "natural, organic remedies" with caution.

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Exploring the Use of Plants in Traditional Indian Medicine

by Sanjna Das, Biological Sciences '22

While we generally think of knowledge in a singular sense—limited to textbooks and scholarly learning— there isn't just one specific type of knowledge, but rather several different types, as described in detail by Elissa Sloane Perry and Aja Couchois Duncan (Perry and Duncan). Of relevance is the concept of foundational knowledge, which includes indigenous and ancestral know-how (Perry and Duncan). The value of indigenous knowledge is apparent even in the medical realm as we continue to search for ways to address the many conditions that result from dysregulation in the human body.

One aspect of traditional healing in India is Ayurveda, which is built upon the notion of achieving energy balance in the body and has long since drawn on plant-based and other forms of natural medicine [1]. Documentation of medicinal plants is complicated by extensive variation in India, the sheer number of plants (of which there are tens of thousands), and the fact that medicines often consist of multiple plants [1]. One plant that may be familiar is turmeric, which, beyond its centrality to Indian cooking, is used for purposes including wound coverage [1]. In fact, when I was younger, my grandma cut herself while washing a mug in the sink and almost immediately packed turmeric powder from the kitchen over the wound.

Medicinal plants are also utilized by tribal groups in India, whom no doubt represent a treasure trove of untapped knowledge. In the Reang tribe, which inhabits the state of Tripura in the northeast part of India, medicinal plants are of great importance to human health [2]. Shil interviewed what they refer to as traditional practitioners and reported that 125 species of plants are used in treating 42 conditions [2]. Medicinal preparation involved six different practices, the most prevalent of which included the formation of a paste and decoctions, where the plants are mixed with water before being filtered [2]. Additionally, researchers reported that plants such as *aegle marmelos*, which is utilized in treating fever and body pain, and *curcuma caesia*, which is used to treat malarial fever, were characterized by high fidelity: a measurement of the agreement among individual practitioners regarding the role of a medicinal plant [2]. A second study focused on the tribal people inhabiting the Andaman and Nicobar Islands of India, where the majority are Nicobarese [3]. The Nicobarese, according to Chander et al. have an intimate relationship with plants for a number of purposes, including their medicinal value [3]. While examining six plants from Car Nicobar Island,Chander et al. found that *D. andamanica* and *M. andamanica*, both of which are native to the area, are characterized by some antimicrobial properties and that *M. andamanica* is notably antimalarial. The antimalarial properties may in fact be rooted in plant compounds such as alkaloids, which were noted in all plant extracts, flavonoids, and sterols [3].

Interestingly, the usage of medicinal plants is not limited to treating the human body. Rather, a study conducted by Usha et al. in the Shervaroy Hill mountain range (Eastern Ghats), which is inhabited by Malayalis, reported that plants are also utilized in addressing animal diseases such as mastitis (inflammation of the mammary gland) and arthritis [4]. In fact, the paper noted that aloe vera is a treatment strategy for mastitis [4].

An understanding of where this vast traditional knowledge comes from is as valuable as the knowledge itself as we seek to preserve it. In a study by Upadhya et al. focusing upon the Belgaum area in the northwest part of the state of Karnataka, it was reported that transmission of traditional knowledge is oral and is generally passed down in the Belgaum area in the northwest part of the state of Karnataka [5]. The study also noted specialization in conditions treated by healers [5], which rises against the perception of such medical knowledge as rudimentary compared to contemporary medicine. Moreover, the process of acquiring medicinal plants carries with it spiritual aspects such as prayer [5].

While factors such as urbanization have affected the preservation of traditional medical knowledge [2], human activities such as deforestation have also posed significant threats, especially as it relates to the availability of medicinal plants in the wild [5]. Though indigenous knowledge may not be characterized by the same experiment-driven methodology as generalized knowing (Sloane and Perry), there is not only cultural value in maintaining a vast body of incredibly diverse knowledge but also medical relevance. A deeper understanding of plants used in traditional medicine across the world may offer novel avenues through which to address disease.

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Artwork by Carina Garcia

Health Forecasting: A Glimpse into the Future?

by Eunice Ju, Human Biology, Health, and Society '24

Why study the treatment for a disease when you can study how to prevent it? This was the question asked by infectious disease specialists when developing the COVID-19 vaccine and is currently being asked by leaders in the field of preventative medicine. Within preventative medicine, there is a new breakthrough that predicts future health events such as demands for health services, known as health forecasting. This breakthrough is a valuable tool that helps "pre-inform health service providers to take appropriate mitigating actions to minimize risks and manage demand" [1]. In other words, it forewarns healthcare systems to prepare for possible health situations. For example, if a hospital could predict the outbreak of a disease, then the hospital could allocate more resources ahead of time to meet the demands of an infected population. These resource allocations are known as interventions and they are used alongside forecasts for better patient outcomes. Other examples of interventions include anticipatory alerts to the general public such as the ones that were released during the second and third waves of the COVID-19 outbreaks.

As a newly developing field, there is no single approach to health forecasting. Most health forecasting is completed through adapted forms of statistical procedures. This requires health data to be collected, which was a difficult process until the emergence of electronic health records (EHR) or "digital health data that is stored in secured repositories and shared only among authorized users" [2]. Using this data, healthcare providers are able to predict many health phenomena. For example, linear regression methods provide accurate results, are easy to interpret, and have wide applications in modeling trends. However, this method incorrectly ignores errors and requires very large amounts of data [2].

Since health forecasting is modeling future events based on available data, it is as much an art as it is a science. Various techniques are used to determine both the accuracy and fit of the models in a forecast. At its current state, no one model is suitable for all. Thus, further research is needed to refine health forecasts to better predict dangerous outbreaks.

One particular disease that has been studied with health forecasting is Chronic Obstructive Pulmonary Disease (COPD) because of convincing evidence that "COPD exacerbations and admissions can be reduced by predicting periods of cold weather coupled with patients' alerts and education" [3]. A study in 2011 observed 157 participants who received varying types of weather alerts. The patients that received anticipatory weather alerts did not see a reduction in hospital admissions from COPD exacerbations [3]. Another study investigating COPD used a "rule-based model predicting risk based on environmental conditions with an anticipatory care intervention. It provides information on self-management and warnings via an interactive telephone call" [4]. Scientists of this study served patients receiving these warnings and concluded that they "added to patients' understanding of their illness and promoted better self-management" [4]. These different outcomes for the same disease further prove that health forecasting is not a "one size fits all" solution.

Artwork by Suri Gime

Therefore, the future of health forecasting remains unclear. Although there are promising outcomes from health forecasting, some argue that using health forecasting to effectively prevent disease will be difficult because "we live in a medicalized society in which it is easier to take an inhaler or tablet rather than it is to change personal behavior" [5]. Additional research is needed for health forecasting to be standardized and to determine to what extent their predictions will be useful in preventative care in the future. Nonetheless, health forecasting offers valuable insight into health trends and should be carefully studied by healthcare systems.

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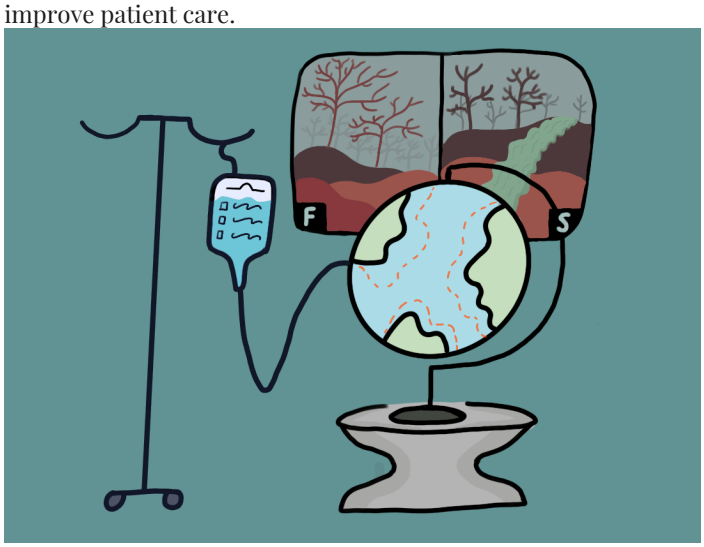
Motivating a Greener Healthcare Industry

by Mark Bodik, Statistics & Biological Sciences '23

The established link between the energy-intensive healthcare sector and climate change represents a two-fold motive for a greener healthcare system; not only would more sustainable healthcare improve the health of the planet, but it would also improve public health as well. However, the impetus to change healthcare, like many aspects of society, lies not in abstract thought but in political and regulatory actions. Fortunately, there are a plethora of pragmatic reasons for greening the healthcare industry, even beyond the obvious health benefits.

Much of the uncertainty behind 'greening' the healthcare industry can be mitigated by looking at successful examples of healthcare systems outside of the United States. A comparison between U.S. hospitals in the Pacific Northwest and Scandinavian hospitals can provide some insight. The U.S. hospital industry spends over $8 billion annually on energy costs, a figure which could be greatly reduced by following the Scandinavian model; the typical Scandinavian hospital uses one-half to one-quarter the amount of energy of the average Pacific Northwestern hospital [1]. Investing in efficiency now could potentially save billions of dollars in the long run, while subsequently reducing the impact of hospitals on the environment and public health. Moreover, the money saved due to increased efficiency could be re-directed towards sanitation, food, renovations, and technological innovations that improve patient care.



Artwork by Kaylah Nicholson

This is not to say that the U.S. is completely devoid of green hospitals; there are a handful of LEED (Leadership in Energy and Environmental Design) certified hospitals that have been built with the intention of embodying social, economical, and environmental sustainability in their form and function. A comparison between LEED and non-LEED hospitals showed cost savings associated with lower energy and water consumption, and an overall savings of over $2 million compared to the replaced facility or to other newer hospitals [2]. Even beyond these pragmatic results, patient satisfaction was found to be 3.6% higher in LEED hospitals than in non-LEED hospitals [3]. Clearly, there are many convincing reasons to take the plunge into making healthcare greener on a large scale, ranging from economic benefits to improved health and satisfaction outcomes.

Understanding the potential benefits of a widespread shift to greener hospitals represents only half the battle. We must also understand the potential barriers to 'greening' in order to take a pragmatic approach that considers all factors. For example, strict infection control protocols, high volumes of heavy chemical use, and the need to function uninterrupted around the clock are just some of the inherent aspects of hospitals that challenge sustainability and efficiency [4]. Of course, within hospitals, there are various contributions to energy use that should be examined individually. For example, a procedure-heavy field like gastroenterology has a larger carbon footprint than others [5]. It may be fruitful to prescribe the responsibility of greening to individual departments rather than cost-intensive complete overhauls of hospitals. Perhaps the most resource-intensive departments could be identified first and could form sub-committees of their own employees to collaborate and determine the most logical next steps for greening that sector of the hospital.

Unfortunately, green hospitals also receive the occasional negative evaluation that may outweigh improvements in inefficiency. In one study, green hospitals generated more revenue on average than non-green hospitals, but also necessitated higher operating costs [6]. This is an important point to consider, though the ultimate price to pay is the continued degradation of the environment and public health if the healthcare industry continues to contribute to greenhouse gas emissions and climate change. In other words, a potential increase in initial cost is well worth the end result: a sustainable green hospital that conserves resources lowers emissions and ultimately does not contribute to the global and public health crisis of climate change.

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The Syrian Healthcare Crisis: 'Brain Drain' and Attack on Healthcare Workers

by Athira Lalu, Biology & Society '23

Dr. Media Rasheed, a fourth-year resident specializing in hematology, was convinced by many family members that she was in imminent danger and had to pack her possessions and flee. Violence had escalated as the country descended into war; both the Syrian Armed Forces and rebel groups committed heinous war crimes including murder, torture, rape, and enforced disappearances of civilians. Furthermore, civilians had been blocked access to food, water, and health services as a method of warfare. Within a matter of days, Dr. Rasheed had left behind her home in Damascus to find refuge in a nearby city of Erbil in Iraq [1].

What began as a series of protests in 2011 against President Bashar al-Assad's regime rapidly escalated into a civil war between the Syrian government and anti-government rebel groups. The war has forced more than four million Syrians to flee the country, many of whom would have been the future generation of physicians. Dr. Media Rasheed explains, "I often feel guilty for leaving my country, as we doctors have pledged not to leave in times of war, but the security situation left us no choice" [1].

In a country plagued by 70 years of conflict, Syria's healthcare system has been severely ravaged and strained. Approximately 70% of Syrian healthcare workers, including the most qualified physicians, have fled the country. The Syrian regime, backed by Russian and Iranian forces, has destroyed most of the country's public hospitals as a strategic bombing tactic to demoralize the disenchanted civilians [2]. Healthcare professionals have gone so far as building hospitals within mountains, such as the Kafr Zita Cave, with hopes of providing medical care while escaping aerial bombardment. In March 2021, Russian forces destroyed a hospital, driving rebel forces out of the area. Unfortunately, these cruel attacks on the already disenfranchised citizens increased the demand for medical assistance, with epidemiological research providing evidence for the use of chemical weapons against civilians. Although the exact number of deaths is unknown, researchers have found many civilians in need of care as direct deaths from chemical weapon attacks are disproportionately reported in civilians (97.6%) compared to military personnel (2.4%); children alone comprise 13-14% of the mortality by chemical weapon attacks [3].

Lack of security and direct targeting of healthcare workers by the tyrants have forced a mass exodus of healthcare professionals, leading to the significant destruction of the healthcare infrastructure. Furthermore, the environment for women like Dr. Rasheed is rapidly deteriorating due to the pervasive violence from an oppressive regime as well as radical Jihadist groups, such as ISIS and Jabat al- Nusra. Cities like Aleppo have been extremely ravaged by bombs, leaving only two vascular surgeons and one plastic surgeon for the entire city. Prior to the conflict, 6,000 physicians served the population of 2.5 million. Now, the number of doctors has dwindled to a mere 20 to serve the entire area. In other cities, such as Ghouta, up to 90% of the healthcare staff have fled the country [4]. The apparent "brain drain" of healthcare workers has become an increasingly vivid reality. Studies of the medical corps revealed more than 50% of medical experts have fled the country in search for better opportunities abroad [5]. Chances of these medical experts returning to Syria are decreasing as the war continues without any signs of cessation, and as refugees seek asylum and settle into their new lives abroad. The resulting lack of skilled doctors has not only placed incredible pressure on the few remaining healthcare professionals, but also increases the risk of complications by necessitating that physicians care for patients beyond their skill sets and capabilities [6].

While the Syrian economy also follows a trajectory towards collapse, the tragic loss of healthcare workers, their skills, and knowledge will have a significant impact on the future of the nation. To combat this, the reconstruction of the Syrian healthcare system greatly depends on support of the youth who remain and feel an ethical responsibility towards rebuilding their nation. Although development in civil society remains marginal due to the region's harsh conditions, citizens across the country have been reconstructing schools, kitchens, shelters, and hospitals in areas that were previously destroyed by warfare. However, while promising, experts are rightfully concerned that the hospitals will remain the primary target by Syrian and Russian forces.

The World Health Organization emphasizes that both parties must respect human rights and cease attacks on healthcare workers and facilities. There must also be provisional investments in the country's healthcare system by the Syrian government and neighboring countries to assist in rebuilding the infrastructure from its foundation [7]. The people of Syria cannot have a prosperous future without proper access to clinics, hospitals, or healthcare professionals. Until the Syrian government and neighboring countries take obligatory action, individuals like Dr. Rasheed will continue to flee and seek refuge in safer regions where they are valued and respected. Though hope does remain, as Dr. Rasheed voices, "the day the war ends I will return to Syria" [1].

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Diagnosing Alzheimer's: A Simple Blood Test

by Kiran Ganga, Human Biology, Health, and Society '24

For decades, we have been trying to find out how to diagnose, let alone cure, Alzheimer's. From expensive tests to long waiting times, some methods of diagnosis seem highly impractical. Is the solution truly just a few drops of blood?

Alzheimer's disease is a progressive condition that results in the degeneration of brain cells and their connections, manifesting as memory loss. It is thought to stem from the abnormal buildup of beta-amyloid and tau proteins. Amyloid buildup forms plaque around neurons, whereas tau buildup forms tangles within neurons. Currently, there is no cure, only temporary treatments and brain exercises to delay the progression of the disease. Developing a treatment is difficult because not enough is known about the biology of Alzheimer's, despite nearly 10% of those 65 and older and 32% of those 85 and older having the disease [1]. We do not even know what causes the buildup of the proteins in the brain. Diagnosis is often delayed because the disease develops gradually and can only be detected when severe and noticeable neurodegenerative changes have occurred. Even when one does get tested for Alzheimer's, the symptoms can mimic those of many other diseases, which complicates the diagnostic process [2]. Moreover, the current methods measuring Alzheimer's disease before symptoms occur are through positron-emission tomography (PET) scans and cerebrospinal fluid (CSF) assays that measure protein presence. These methods are expensive, invasive, and inaccessible [3]. Over the course of the diagnostic process, the patient's condition continues to escalate without proper treatment or attention.

C2N Diagnostics' Precivity AD blood test, aimed at those 60 and older, has allowed for potentially more objective measures for Alzheimer's. The blood test aims to measure brain amyloid protein levels and has been accurate in identifying status in 86% of patients. This can be compared to a 70% accuracy of symptoms-based tests. Though clinical diagnosis is still needed, this blood test would serve as an inexpensive and accessible tool to aid doctors and patients. Compared with current methods of diagnosing Alzheimer's, the blood test is non-invasive and involves no radiation. The test generates an Amyloid Probability Score (APS) from a blood sample collected from an individual's forearm. The probability score is then used to assess the likelihood of amyloid plaques in the brain. While a low APS score would provide the same information as a negative amyloid PET scan, a high APS score would provide the same information as a positive PET scan and indicate a high likelihood of amyloid plaques. Through coupling this result with clinical diagnosis, patients can receive treatment earlier to delay progression [4].

C2N is the first company to have developed a blood test for Alzheimer's that is now available in most U.S. states. The price of the test is $1,250, which is quite expensive. Those who qualify for financial assistance will be charged between $25 and $400. C2N CEO Joel Braunstein states that decreasing this price is a high priority for the company, especially considering that health insurance companies do not currently pay for the test and that physician approval is needed [5].

Artwork by Flavia Scott

This blood test is considered a great feat, as many had thought that the blood-brain barrier would make such biomarkers, like amyloid status, impossible to analyze because of their relative scarcity in the blood, but the high sensitivity of the blood test is able to address this issue.

Though this innovation is impressive, there are limitations that we must consider. The first criticism is that there is not yet enough data on this test for it to be commercially viable. Some key test results have not even been published. The second criticism is that it is not FDA approved. Heather Snyder, the Alzheimer's Association Vice President of Medical & Scientific Relations, stated that no endorsement of the test will come from the organization until FDA approval is received [6]. These limitations mean that test results may not be generalizable or interpretable. Moreover, some researchers have indicated that biomarkers of tau proteins would be far more important, especially considering that they are better at distinguishing Alzheimer's from other forms of dementia.

It seems as though this amyloid blood test has opened the door for development in tau blood tests. Thijssen et al. (2020) have found that a higher plasma p-tau181 level is correlated with a faster cognitive decline over 2.5 years. Further, they found that people with the highest levels are likely to develop Alzheimer's over a period of up to 8 years [7]. Cullen et al. (2020) has demonstrated that p-tau181 did the best in predicting Alzheimer's progression over 4 years, in comparison to other tau and amyloid proteins [8]. However, there is no tau blood test on the market.

If the C2N Diagnostics blood test becomes more affordable, substantiated with data, and suggested by physicians, it is definitely a viable option. It is expected that tau blood tests will soon be on the market as well, which would allow competition to lower the price and, hopefully, create more accessible and accurate blood tests. It is exciting to see rapid progression towards blood tests that allow patients to take more preventative measures. This test may encourage the development of blood tests for analysis of other neurodegenerative diseases.

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The Future of Biotechnology

by Ronit Kumar, Biomedical Engineering '24

What if we had the ability to cure cancer, treat blindness, develop "super" plants, or remove diseases from infectious organisms? Furthermore, what if we could accomplish all of those tasks with the power of just one technology? Clustered regularly interspaced short palindromic repeats, better known as CRISPR, is a genetic engineering technique that was thrust into the spotlight as recently as 2015 and can be used to modify the genomes of living organisms [1].

The mechanisms of CRISPR are based on the bacterial CRISPR-Cas9 antiviral defense system. Researchers modified RNA with a guide sequence that binds to a specific target sequence of DNA in the genome of an organism as well as the Cas9 enzyme. The Cas9 enzyme cuts the DNA at the binding location. Researchers then use the cell's DNA repair machinery to alter components of the genetic material however they see fit [2]. This technique has been highly praised in the world of biotechnology and medicine as it enables genes to be edited in vivo (within a living organism) with very high accuracy at a low cost. As briefly mentioned earlier, its applications are incredibly extensive, which has contributed to its increasing popularity.

Fortunately, some of the immense implications of CRISPR technology have already been realized through many clinical trials that have already been performed. These trials have yielded favorable results regarding the fate of future medicine and genetic engineering. Since 2018, hundreds of clinical trials have been conducted to test the capabilities of CRISPR in treating Huntington's disease – a neurodegenerative disease that results in the death of brain cells over time. It was determined that CRISPR could be used to remove the cytosine, adenine, and guanine repeats found in the HTT gene known to cause the disease, effectively curing it [3]. Additionally, as recent as March of this year, the FDA approved the first test of CRISPR to correct a genetic defect causing sickle cell anemia, a common blood disorder. CRISPR was used to correct the mutation in the beta-globin gene which is responsible for the disease [4]. While these trials are still underway, there have been promising results thus far.

Given our current circumstances amidst the COVID-19 pandemic, one might be inclined to ask if CRISPR could potentially play a role in vaccine development. The short answer? It already has. Both the Pfizer and Moderna vaccines are the first vaccines ever to be activated by mRNA (messenger RNA sequences), which would not have been possible without CRISPR gene-editing technology. In addition to these vaccines, there is now an increased emphasis on quick and efficient COVID testing given the likelihood of new strains of the virus arising. Recently, researchers in Singapore have developed a CRISPR-based COVID test that takes roughly thirty minutes to arrive at a positive or negative test. The test involves dipping a small paper strip into a medium containing a nasal sample. This paper strip contains a specific enzyme that will react with the virus if present. Depending on the reaction, one or two bands will appear on the strip which indicates a negative or positive test respectively [5]. Given how quickly viruses can mutate their genetic code, rapid and accurate tests such as these are instrumental in detecting the virus early and containing its spread.

Beyond medicinal applications, CRISPR has been implemented in the creation of "super" plants – plants that transcend the capabilities of ordinary plants in promoting a sustainable environment. It is undeniable that global warming is becoming a major problem that threatens the lives of countless species across the world. Scientists have determined that the global annual temperature has increased at an approximate rate of 0.08 °C per decade since 1880. This rate has more than doubled in the last forty years with an increase of 0.18 °C per decade since 1981. In response to this major conflict, plant scientists have attempted to create plants that absorb significantly more carbon than usual by storing excess carbon dioxide in their roots. As simple as the idea sounds, on a large scale, this would remove enough carbon dioxide from the atmosphere to impede climate change substantially [6].

While it appears as if CRISPR has the potential to solve many of our ongoing and future scientific problems, there are many ethical considerations that should be noted. As beneficial as gene editing can be, it comes in many varieties and can have many consequences. For example, germline gene editing affects all cells in an organism unlike somatic gene editing which only affects some target cells. If germline editing is performed in vivo on a patient, it can affect their egg or sperm cells which can then be passed onto future generations. Such modifications could produce an unintended chain reaction of effects that result in healthy cells not functioning properly [7]. Ultimately, the consequences of this are too difficult to predict, and utmost caution should be

Artwork by Carina Garcia

exercised at all times while performing CRISPR editing if it is deemed ethical in the first place.

All things considered, new possibilities of CRISPR technology continue to be realized on a daily basis. With its profound impact in changing the tide of the pandemic along with curing once "incurable" diseases, time will only tell what CRISPR has in store for us.

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Retraining the Brain

by Anika Kumar, Human Development '23

Is it possible to retrain your brain to become an entirely new person? What if all of a sudden, after months of feeling lethargic and unmotivated, you suddenly become energized and excited to complete even the most mundane tasks? Many people are aware of common methods to sharpen cognition and improve mental health, such as meditation, yoga, and a healthy diet. However, new therapeutic technologies have made it possible to completely reprogram the brain through self-regulation of electrical activity [1]. Neurofeedback is one procedure that utilizes operant conditioning in teaching individuals to recognize and change abnormal brain wave patterns. This technique has the potential to treat some of the most complex mental disorders, and even a healthy brain can benefit in astounding ways.

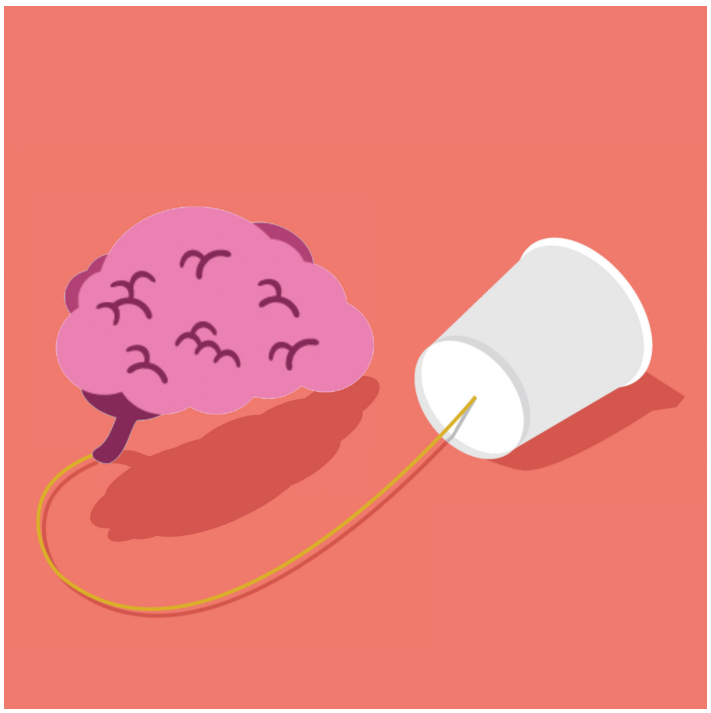
All thoughts, behavior and emotion are dictated by brain waves - electrical impulses produced by masses of neurons communicating with each other. While beta waves are associated with a state of intellectual activity and concentration, alpha waves are designed to induce a state of relaxation [2]. If brain wave patterns are abnormal, an individual may have trouble with concentration, memory, and mood. In these cases, learning self-control of brain waves may be key to long-term improvement.

Neurofeedback is a technique that teaches the brain to make normal transitions between brain wave states. An electroencephalogram (EEG) is first used to measure the electrical activity of the brain, and feedback signals are emitted in the form of audio or visual reinforcement [1]. For example, if the patient produces the targeted brain waves, a sound or specific color may be displayed on a screen to signal success. In some cases, a patient may be asked to play a hands-free video game such as Pac-man. Only the detection of desirable brain waves will move the character across the screen towards its goal [3]. Through such reinforcement, patients learn to recognize and voluntarily change the electrical patterns of their brains.

Although neurofeedback utilizes relatively new technologies, it is grounded in an ancient understanding of human development. It has been widely known that reward is a strong motivator in learning. In the 1960s, Professor Joseph Kamiya at The University of Chicago became the first person to utilize EEG neurofeedback training to explore the intersection between reinforcement through reward and self-regulation. In one study, he trained individuals to achieve an alpha state by rewarding them with the sound of a bell [4]. Over time, patients reported being able to produce alpha and non-alpha states at will, resulting in the reduction of stress and anxiety. Years later, researchers at UCLA were able to train cats to produce brain waves that made them resistant to chemically induced seizures [5]. When this procedure was applied to humans, it successfully decreased seizure activity by 65%.

However, studies have shown that this retraining of the brain may be even more effective than medication in treating several disorders [6]. Medications can be addictive; the brain may build up a tolerance to some medication, and higher dosages may result in increased dependency and side effects. On the other hand, the brain simply learns to self-regulate on its own with neurofeedback. Thus, there is no dependency on any external substance, and the effects continue into the long-term, even after halting sessions. Currently, there are no known side effects, and the treatment is often much cheaper than medication, making it a great alternative option to pursue. Interestingly, patients have also reported an improvement in overall attention, mood, and mindfulness, suggesting that the procedure may be able to benefit mental wellbeing beyond the treatment of mental disorders [1].

Those that do not suffer from any mental illness have turned to neurofeedback in hopes of improving their cognition and emotion regulation. In many of these patients, the therapeutic approach has resulted in enhanced memory and focus, better mental clarity, restful sleep, decreased anxiety and impulsivity, and improved mood [7]. In fact, the technique's ability to reduce distracting emotions has been shown to aid in sports performance, making it particularly advantageous for athletes [8]. The stabilization of emotional perception, including the ability to cope with stress, makes instances of high cognitive demand easier to manage. Furthermore, neurofeedback has the potential to slow cognitive decline [8]. With age comes the natural decline of certain areas in our brains, but in the same way that physical exercise keeps the body in prime physical shape, neurofeedback acts as a mental exercise to help maintain brain health. Moreover, its effect on attention, memory, problem-solving, and processing speed may actually help make an individual smarter. Studies show that IQ scores rise 10 to 20 points after training [9]. This technique



Artwork by Suri Gime

certainly seems like an appealing option for strengthening the mind, although more research must be conducted to verify these results.

In conclusion, neurofeedback has much potential to improve overall wellbeing and longevity. However, the lack of sufficient research investigating the technique's impact has prevented it from becoming as well-known as other brain-boosting foods and exercises. Some scientists claim that past studies measuring neurofeedback's effects were improperly conducted. Many lacked control groups and appropriate blinding, thereby increasing the chances of a placebo effect [10]. Yet despite such criticisms, testimonials remain very promising, and the technique's rising popularity drives researchers to continue exploring its life-changing benefits.

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Focused Ultrasound Provides Minimally Invasive Treatment for Parkinson's Patients

by Amer Ahmed, Human Biology, Health and Society '22

Artwork by Caroline Mendoza

New advances for reducing tremors are improving the quality of life for people with Essential Tremor (ET) and Parkinson's disease (PD). With applied pulses of focused ultrasound to the brain, dreams can become reality.

The defining feature of those suffering from Parkinson's disease is tremors, which are involuntary muscle movements that occur in all parts of the body, most commonly in the hands. Patients with Essential Tremor – a disease that affects the nervous system– also experience involuntary and rhythmic shaking. PD and ET combined affect millions of people all over the world [1].

When medications do not work, the usual treatment to reduce tremors is deep brain stimulation. Deep brain stimulation works like a pacemaker in the brain by surgically implanting a small electrode connected to a pulse generator. One major risk of deep brain stimulation is an increased likelihood of bleeding and infection, as is the case with any invasive surgery [1].

Thanks to groundbreaking advancements in the field, there is now a new treatment option: magnetic resonance-guided focused ultrasound (MRgFUS) thalamotomy. The focused ultrasound treatment is a non-invasive interventional radiology procedure where "focused beams of sound energy are used to heat and destroy a small part of a structure in the brain called the thalamus. The procedure gives relief to the opposite side of the body, meaning that treatment to the right side of the brain would relieve tremors on the left side of the body, and vice versa." [2]

The way the focused ultrasound works can best be understood with an analogy. Imagine shining a magnifying glass on a leaf; the sunlight shines through the magnifying glass and its sunrays all converge to burn a hole on a single point in the leaf. "With focused ultrasound, an acoustic lens is used to concentrate multiple intersecting beams of ultrasound on a target deep in the body with extreme precision and accuracy. Depending on the design of the lens and the ultrasound parameters, the target can be as small as 1x1.5mm or as large as 10x16mm in diameter". The technology utilizes low or high pressure waves to apply both thermal and mechanical energy [3].

The non-invasive procedure avoids the risk of infections and bleeding from surgery, as well as the time of treatment delivery. Whereas deep brain stimulation needs time to adjust for electrostimulation, the focused ultrasound delivers its effect immediately. The new treatment is also less painful, requires a shorter time of hospitalization, and substantially and immediately

reduces tremors [3].

Dr. Federico Bruno led the study titled "Efficacy of tc-MRgFUS Thalamotomy in The Treatment of Essential Tremor (ET) and Parkinson Disease (PD) Tremor: Experience From 39 Patients in A Single Centre with Long Term Follow-Up". The study utilized a study cohort of patients (average age 64.5 years) who experienced tremors for more than 10 years; researchers assessed the tremor severity and quality of life for these patients before focused ultrasound treatment, immediately after treatment, and over the year after treatment. They found that in 37 of 39 patients, about 95%, had an immediate and significant reduction of tremors, and the tremor reduction remained consistent over the course of the year following treatment. Quality of life improved for the 18 ET patients and 21 PD patients [4].

These are really exciting and promising results and, as more findings regarding the treatment get published, the number of focused ultrasound sites could expand, especially with its clinical use approved by the FDA in 2016. An obstacle remains, however, as there are limited specialized centers that offer this technology and not many patients are aware of this treatment option. Furthermore, there are additional challenges to overcome in the near future, including the precision of neuroimaging techniques. Overcoming these obstacles will require attention to detail, implementation, and monitoring in order to expand the availability of focused ultrasound treatment [2].

The future possibilities are endless. More research and development may yield the possibility of treating both sides of the thalamus, as well as using the focused ultrasound technology for disorders other than tremors. There are currently clinical trials to use this technology for other neurological conditions like obsessive-compulsive disorders, epilepsy, neuropathic pain, and even brain tumors [5].

Focused ultrasound is a new and exciting treatment for tremors that is minimally invasive, safe, and well-tolerated by patients. It brings an alternative treatment option to the table for PD and ET patients, with a high efficacy rate. More research can expand sites that deliver this treatment, as well as treat other neurological conditions.

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(Insta)nt (Gram)tification: Social Media Addiction and its Effects on Dopamine

by Vivian Chiang, Human Biology, Health, and Society '24

In the midst of a pandemic, social networking sites (SNS) have been pivotal in maintaining our social lives, but offer convenient distractions that drain productivity and deteriorate mental health. Yet, even before the pandemic, social media addiction, characterized by the uncontrollable use of social media, has been a prevalent yet mysterious problem due to unknown neurobiological mechanisms. Much like the parallels observed between drug addictions and other behavioral addictions, there is a clear link between dopamine, triggered by rewards such as "likes," reinforcing the irresistible draw towards social media. Scientists speculate that social media addiction can lead to a decrease in dopamine receptor density, release, and binding. By understanding the changes to the dopaminergic pathway, scientists can promptly point out more effective treatments to guide individuals in regulating healthy social media usage.

From an evolutionary perspective, seeking social interactions is classified as a primary drive. The drive to maintain social bonds is a type of goal-oriented social behavior, regulated by the neurotransmitter dopamine secreted in the nucleus accumbens (NAcc), a region in the ventral striatum and a major aspect of the reward system. Dopamine released from the striatum mediates the conditioned response after repeated exposure to social stimuli, which produces a positive emotion that motivates continued social behaviors [1]. Through sharing aspects of our lives, we find that doing the same to connect on social media platforms not only conveniently satisfies our fundamental social needs, but also easily reinforces continued use.

Maintaining reputation in society is also considered a social reward-driven by natural selection. "Likes" on SNS platforms easily become a form of currency that quantifies online popularity and delineates social reputation. Across all age groups, the instant gratification received from each "like" increases activity in the striatum [2]. A "like" provides positive feedback for the recipient, thus indicating a positive view for the particular user and their reputation. This can also be seen in how individuals tend to give "likes" to popular posts, even to those portraying illegal behaviors, suggesting that the number of 'likes' can change the other's perception of a post [3]. In other words, "likes" are strong social rewards that can

Artwork by Nabiha Zaman

reinforce social behavior by signifying acceptance from others in society. Because the striatum also encodes for habitual behavior, when "likes" activate the reward system encompassing the NAcc and the striatum, the positive feedback loop that drives social interactions is initially enhanced, eventually shifting to neural circuits that reinforce habitual use in the same region [4]. Knowing the reward circuitry is mediated by dopamine, excessive social media use may thereby have significant effects on dopamine function.

To better understand social media addictions, compulsive behavior can be drawn in parallel to other addictions, the most well-known being substance abuse. Disrupted dopamine function has been reported through a series of PET scans that consistently demonstrate at least a 20% decrease in D2 dopamine release and receptors in addicts' striatum [5, 6]. Yet, these results are repeatedly demonstrated with other various behavioral addictions without the influence of chemical substances. Both internet addicts and patients with morbid overeating tendencies were found to have a lower D2 dopamine receptor density [7, 8]. Moreover, PET scans in pathological gamblers reveal decreased dopamine binding potential in the ventral striatum [9]. Thus, these findings, when taken together, suggest how behavioral addictions are also similar to substance addiction, especially via alterations in dopamine function. Because striatal dopamine regulates the saliency and motivation for rewards, the reduced striatal dopamine release along with decreased dopamine receptors may overall account for decreased sensitivity of the reward circuit to other "natural" reinforcers in addicted patients [5]. Therefore, this could explain why the subject will continually seek the 'reward' despite the detrimental effects to stimulate the same pleasurable "high" in the disrupted dopaminergic pathways. Seeing how social media addiction is also a form of behavioral addiction characterized by tolerance and withdrawal symptoms, long-term excessive social media usage may also lead to the same lowered dopamine release, binding, and receptor density.

Thus, altered dopamine function may affect projections to other components in the reward system that explain the increasing correlation with mental health disorders such as depression and anxiety. Catalyzed by the pandemic, some may start prioritizing the virtual media platform instead of in-person interactions as a coping mechanism [10]. Furthermore, there is an increased fear of missing out (FOMO), leading to anxiety whenever one is disconnected from the virtual world [11]. By finding out how long-term social media addiction affects dopamine neurologically, scientists can point to more effective treatments to prevent the commonly experienced symptoms. As society increases the reliance on social media, understanding the neurological impacts becomes even more important to guide healthy social media usage and bring awareness to our wellbeing.

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Virtual Clinical Trials

by Shilvaan Patel, Policy Analysis and Management '24

The COVID-19 pandemic has forced us to reimagine social interactions from a personal level to a global one. While the pandemic has limited the feasibility of certain options, it has expanded incentives for others. Travel restrictions, site closures, and quarantine requirements, for instance, have made it difficult for companies to perform clinical trials, prompting many to use Virtual Clinical Trials (VCTs) during the pandemic [1]. Although VCTs existed prior to the pandemic, they have grown in popularity as a means of navigating these pandemic restrictions [2].

There are many different types of VCTs but at their core, all VCTs incorporate some form of digital health technology. These integrations range from traditional in vivo trials with a virtual "clinic visit" to fully completely virtual trials where the human subject is replaced with a "virtual digital phantom" or a digital file used to emulate the clinical process without actually conducting a clinical trial [3]. These different trial formats are advantageous in various situations.

Artwork by Caroline Mendoza

Clinical trials, for example, have encountered a wide range of challenges during the COVID-19 pandemic. These include prioritizing patient safety amidst the pandemic, recruiting new research patients, data gathering and management, and intervention delivery. The increased utilization of clinics for COVID care has made it more difficult to conduct the "clinic visits" during a clinical trial. These clinic visits are a key part of the trial, as they are an important part of both safety monitoring and data collection [4]. Thus, virtual clinic visits, which can take place over phone calls, video conferences, or even reporting health metrics in a mobile app, can be extremely useful for companies conducting in vivo trials during the pandemic [4].

However, in other contexts such as medical imaging, completely virtual trials can be beneficial for different reasons. By generating a digital population that undergoes a virtual scanning process, medical imaging device makers can emulate clinical trials at a fraction of the original time and cost [3]. Furthermore, these completely virtual trials can assess the utility of these medical imaging devices while minimizing risks such as exposure to radiation [3].

While VCTs provide companies with greater flexibility when performing trials, they are not without disadvantages. While patient privacy concerns are the most prevalent issue, other barriers such as a lack of access to certain technologies in rural areas and technology failures or shortcomings are all salient concerns with VCTs [4]. Moreover, the human body is more complex than we currently know, and using digital populations in fully simulated trials may struggle to represent this fact and subsequently fail to catch the full range of adverse effects a device has on human subjects [5]. While it is likely that these issues (especially the technological ones) will likely be ameliorated as VCTs become more common, they should nonetheless be important considerations for any organization considering conducting a VCT.

During these difficult times, we have been forced to adapt to a "new normal" in order to comply with pandemic restrictions and ultimately preserve our health. As vaccinations progress and we look forward to a return to the world as we knew it, whether VCTs are a part of this future remains to be seen. Nonetheless, for the time being, we may be in the midst of the golden age for VCTs.

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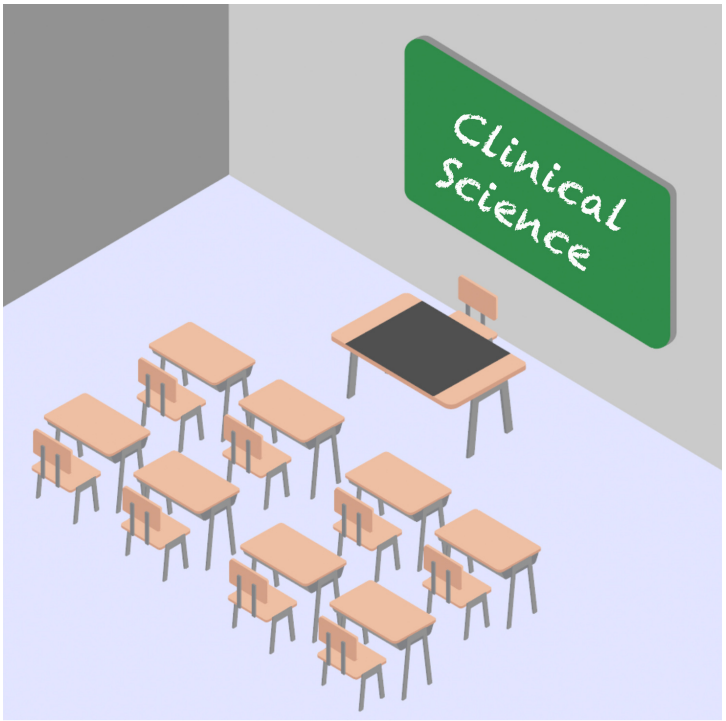
Translational Medicine in the Artificial Intelligence Era

by Rushil Shah, Human Biology, Health, and Society '22

Endless hours of laborious work, billions of dollars spent testing hundreds of drugs, and extremely high rates of error riddle the contemporary market for creating a new therapeutic compound. The barrier to entry for most scientists is too high, as they are not certain that their new molecular discovery is translatable to improvements in clinical outcomes. However, recent advancements in technology and computer science have developed tools to pre-screen molecular compounds in an artificial (in *silico)* environment. reducing the costs of generating ineffective compounds, and producing a significantly higher degree of small-molecular compounds to target novel pathways for translational medicine.

Generally, the structure for clinical advancements and therapeutic pipelining follows a 20+ year timeline from when a molecule receptor is first discovered to the actual prescription of a drug or a trial. Typically, a scientist discovers a novel biological property related to a specific condition, which goes through a series of different animal model tests prior to beginning experimentation in a human. In addition to these different models, compounds have to be generated in new and unique ways to fully target the health condition of a patient. In this process, new therapeutics are pitted against previously identified pathways and truly testing if a compound is needed, compared to the other products on the market. Finally, once they have made these compounds and tested them in a clinical trial, the issue becomes how generalizable the trial is, how the results from this trial can be used to alter the specific treatment courses for different patients, and which criteria are used to delineate between different treatment styles. However, advancements in artificial intelligence (AI) and machine learning (ML) have been used to identify a number of core challenges in biotechnology: In silico testing of molecular compounds, Generating more streamlined assessments and augmentations of existing data and finally, combining genetic and clinical data to generate precise medical modeling [1].

With respect to in silico testing of molecular compounds, different AI and ML tools have been deployed with hopes of creating a virtual environment to test compounds prior to clinical trials. Companies like Atomwise have been created to root out treatments based on a database of molecular structures. This company focuses on testing unknown combinations of safe and existing medicines to find out if the drug is likely to combat the disease. This modeling was even used during the screening for Ebola medications, as it only took the company a few days to find two compounds effective at reducing the infectivity of Ebola [2]. In addition to this, the company has been using this same approach to commercialize and market to basic science researchers around the country. Rather than painstakingly derive the molecules and animal models appropriate to test a new compound, they can readily send the biological and biochemical information to these AI/ML researchers who can identify the effectiveness of a novel medicine using their algorithms [3]. With their algorithm for in silico testing, they can screen billions of different compounds set against hundreds of different biological receptors to get extremely accurate models of compound receptor interaction. However, the only limitation on this model is that they are generally developing small molecule drugs, which are typically used for pharmacological purposes but evade the newer classes of molecules like biologics and monoclonal antibodies which might have more functionality down the line.



Artwork by Suri Gime

Outside of generating new molecules, there are also groups dedicated to altering drugs already on the market that can be used for patients with other conditions. Other research groups or companies are dedicated to repurposing generic medications for specific rare conditions. RebootRx, a company dedicated to innovating and testing existing drugs on the market for cancer patients. This approach yields itself to becoming a non-profit startup dedicated to improving affordable and available cancer treatments. This has been supported in the literature, as it is perceived as one of the most practical and pragmatic actions that could be taken to innovate cancer treatment in the short term [4]. This approach uses AI and ML to look at the already existing clinical trial data as well as post-market evaluations of certain drugs that are already on the market for different oncological conditions. The goal of this is to optimize treatment outcomes for those with complex cancers and to create more functional opportunities to make truly precise medicine treatment courses and models [5, 6].

Overall, AI is rapidly transforming the landscape of translational medicine. It is changing the pipelining to discovery, minimizing the cost of research, maximizing the testing, and increasing the efficacy of therapeutics on the market. Using the tools of AI, we may truly be able to have individually tailored medicine.

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Weighing the Implications of 'Breast is Best'

by Abraham Kheirbek, Biology and Society '23

Despite our intricate civilizations and complex societies, humans are mammals at their core, products of the same evolutionary lineage as our fellow hominids. Among having hair and being warm-blooded, breastfeeding is the natural way mammals feed their young, and humans are no different. In 2018, a resolution on this crucial part of mammal life reached the floor during the World Health Assembly in Geneva. The resolution was seemingly good-natured, stating that natural breastfeeding should be encouraged over formula products and that governments should strive to regulate misleading advertisements on formula breast milk substitutes [1]. Approving the resolution seemed like an obvious choice; years of scientific research on the health benefits of natural breast milk have given rise to the motto "breast is best" in the pediatric community. While the resolution was endorsed by many nations, the United States opposed the proposal, even threatening to "unleash punishing trade measures and withdraw crucial military aid" from Ecuador, the nation that proposed the resolution [1]. Uncovering why the United States not only rejected the proposal but did so as intensely as it did, calls for an analysis of the interplay between the benefits of formula and those of breastmilk. The question becomes more complicated, however, upon dissecting the ramifications of pro-breastfeeding campaigns.

Science is all but settled on the health benefits of breast milk. While scientists have observed a myriad of benefits from nursing with breast milk over formula, little is known about the biological mechanisms behind many of these benefits. Breastfeeding is widely associated with postnatal disease reduction, such as "up to a 30% reduction in the incidence of type 1 diabetes mellitus" or a "reduction of 52% in the risk of developing celiac disease in infants who were breastfed at the time of gluten exposure" [2]. These benefits become especially important when discussing breastfeeding in preterm infants, in which physicians observe "fewer hospital readmissions for illness with breastfed infants in the year after NICU" (neonatal intensive care unit) discharge, as well as "a significant reduction (58%) in the incidence of necrotizing enterocolitis" - a life-threatening infection that can rupture the wall of the infant's intestine [2]. Further into infant development, breastfeeding exclusively has also been found to have a positive effect on the development of infants' white matter, which "facilitates the rapid and synchronized brain messaging required for higher-order cognitive functions" [3]. However, like many observations on the relationship between breastfeeding and infant health, "the mechanisms underlying these...differences remain unclear" [3].

Artwork by Suri Gime

Deciphering the United State's fervent rejection of the resolution brings an elaborate history of formula industries and their marketing into the debate. A widespread concern from those who oppose formula advertising from companies like Nestle is their history of advertising in "areas without clean water", which has led to thousands of infant deaths [4]. At the surface, the United State's fervent advocacy seems to be in an effort to appease the "$70 billion [formula] industry...dominated by a handful of American and European companies" [1].

Nevertheless, skepticism towards the efficacy of pro-breastfeeding campaigns is not completely unfounded. Since 1981, a long history of "the World Health Organization['s]....resolutions aimed at increasing breastfeeding rates" has left many mothers for whom natural breastfeeding is not an option in the shadows [4]. In the opinion of many mothers, pro-breastfeeding initiatives have often grown aggressive at the patient-care level, demonizing formula to new mothers who are rightfully seeking what's best for their baby [5]. Many hospitals, adamant in promoting breastfeeding, keep their formula under "a lock and key", out of sight from patients, and oversimplify breastfeeding as a natural process absent of the difficulties that many mothers face in feeding their infants [4]. In this sense, pro-breastfeeding campaigns can often stigmatize the use of formula, whereas for some mothers formula is their only option.

Though breastfeeding is a natural process for all mammalian mothers, many mothers cannot or should not breastfeed. For example, dependency on illegal drugs or medication can alter breast milk composition and lead to adverse effects for newborns. The transmission of illicit drugs through breast milk can cause "irritability...growth problems, neurological damage, and even death" for infants [5]. Additionally, certain medications can cause side effects such as "a decrease in milk supply" or the production of breastmilk that is harmful to the baby [6]. Breast milk also has the potential to be a site of infectious disease transmission, as diseases like HIV or active tuberculosis can be carried through breast milk [5]. Soreness, difficulty with babies latching, and other common problems can also pose obstacles to breastfeeding [4].

A balance must be struck between the promotion of breastfeeding as a healthier alternative to formula and the active effort to not demonize formula for mothers who should not or are unable to breastfeed. The United States could move in the right direction by requiring longer or paid maternity leave for mothers; this strategy has been promoted by the Surgeon General as a way to promote higher breastfeeding rates among mothers [6]. In 2004, "California was the first state in the United States to implement a paid family leave"; research into the program's effect on breastfeeding rates found "an increase of 10–20 percentage points for breastfeeding at several important markers of early infancy" [6]. Additionally, employers and public institutions should work towards destigmatizing breastfeeding in public or professional spaces, making breastfeeding more accessible for mothers. Research into lactation-friendly workspaces has shown "that for every $1 invested in creating and supporting a lactation support program (including a designated pump site that guarantees privacy, availability of refrigeration, and appropriate mother break time) there is a $2 to $3 dollar return" in net profits [2]. On the other side of the debate, while it is crucial to regulate advertising by formula companies to prevent adverse post-natal outcomes, more work must be done to improve the doctor-patient relationship in terms of providing accurate information on formula feeding, especially during a time as vulnerable as after child-birth.

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Health Wearables: Innovation and What it Means for You

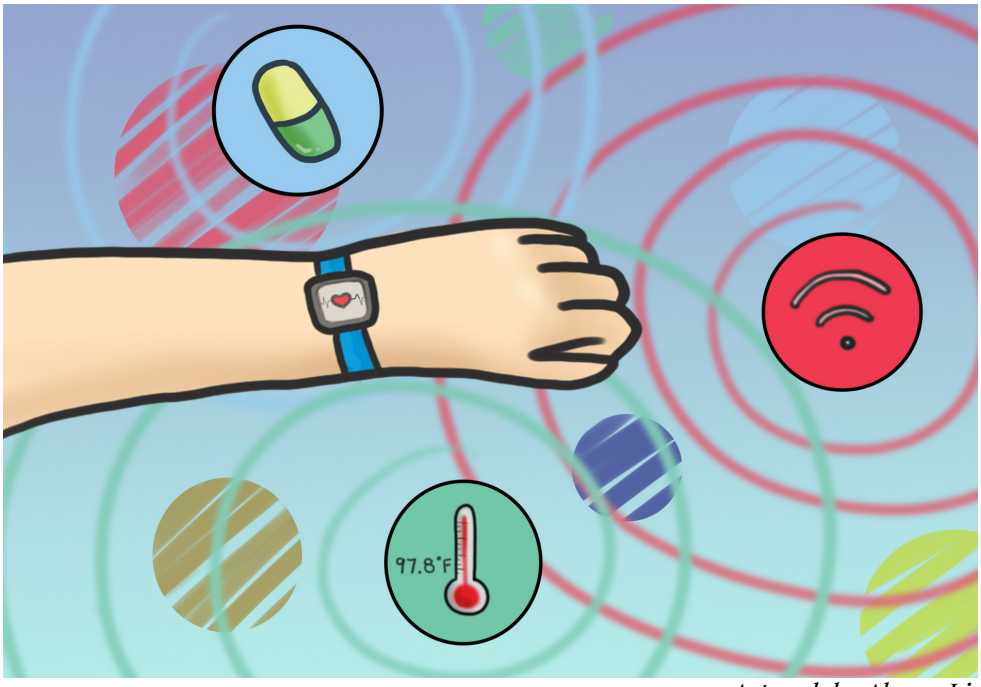
by Philip Lee, Biological Sciences '22

Wearable devices, or wearables, are already revolutionizing medicine through mobile and digital health by enabling continuous, longitudinal health monitoring outside of the hospital [1]. Wearables enable consumers to continuously monitor important physiological and biochemical parameters during daily life.

In its early stages, wearables were limited to tracking a person's weight loss or step count. However, consumers are no longer satisfied with these basic parameters [2]. Advanced performance metrics like body fat percentage, sleep quality, stress levels, and water levels are in high demand as people are starting to discover that one's overall health is the sum of all the small daily choices: how much one drinks, how much one sleeps, how much one moves [1]. Innovation in the realm of personalized health technologies offers a unique opportunity to develop connected healthcare models built around a patient's individual needs. This marks the increasing and the evolving role of wearables in modern medicine.

There are some mobile applications that have taken advantage of the increasing complexity of wearables, and the health data and have essentially "gamified" healthy activities and habits such as daily exercise, fasting, and consuming a healthy, balanced diet.

One such example is "Zombies, Run!", a viral mobile application available on The App Store which currently has over 400,000 downloads. Consumers can link their wearables (most commonly a smartwatch or fitness tracker) to the application and can track certain health metrics in the context of the game. For instance, "miles run" is read as "zombies evaded," and more "zombies evaded" means more in-game points and benefits. One study found that positive and negative reinforcement through gamification of inherent goals resulted in an increase in the actual health behavior that was being targeted [4]. However, this gamification of health behaviors would only be possible through the health tracking sensors on a consumer's wearables, and it will be exciting to see what mobile health app developers and wearable



Artwork by Aleena Li

In today's market, 19% of Americans use a wearable fitness tracker (e.g. Fitbit, Apple Watch, Garmin, etc.). Sales are projected to double by 2022 wearables are predicted to become a $27 billion market, with no signs of slowing down [3]. Basically, it is a very lucrative field, and the consumer demand for more personalized insights has pushed manufacturers to produce highly capable smart wearables that are able to track water loss, blood oxygen content, and even predict atrial fibrillation (in the case of Apple Watch). What this means for the consumer is that in a few years, innovations in health wearables will have produced a wearable that can track the minutiae of human health.

manufacturers can come up with in the future to further optimize this experience and motivate more people to engage in healthy behaviors. While they may be lucrative for the private healthcare industry, wearables will undoubtedly lead to better health outcomes as well, as they are more personalized and offer more clinical insight for physicians and medical scientists to hone in on certain health trends and invent therapeutics to match a patient's specific healthcare needs [5].

Widespread adoption of wearables might even save the healthcare industry millions of dollars in the long run. A wearable that could

theoretically allow physicians to track patients' conditions from a distance would eliminate the cost and need of transferring them to a medical facility if the patient begins to develop symptoms [6]. Recognizing symptoms at an early stage allows for less expensive treatments, which highlights the impact wearables can have on the shift of medicine towards a preventative model of healthcare that reduces in-patient care and potentially leads to better health outcomes [7].

Wearables have the potential to change the landscape of medicine as we know it. Its effects are not limited to the private healthcare sector, and future innovations to wearables can have broader implications for the future of healthcare. Joining technology and medicine in this way is the new face of modern medicine, and it will be exciting to see the direction wearables will go and how consumers will benefit from them.

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The Role of Rice and Beans: Nutrition as Medical Treatment

by Ilana Schachter, Nutritional Sciences '22

The smell of spicy, warm comforting red beans and bright, fluffy white rice wafts through the air. You take a bite and immediately smile as the flavors and textures blend miraculously. Forming a complete protein and supplying all nine essential amino acids, rice and beans have been a staple food for millennia Furthermore, with 13,000 varieties of beans to try, the options are endless. Originating in South America, black beans are common in Latin American and Caribbean cuisines, while chickpeas' origins in Europe make them a common choice in Middle Eastern and Indian dishes. Black beans, chickpeas, red beans, pinto beans, lentils and many more legumes are most commonly consumed with a grain such as rice, tortillas, or potatoes [1]. Though tasty and a well-known staple, can this magical combination be deemed healthy?

Scientists have found that, for populations at higher risk of developing diseases, the promotion of traditional foods, such as legumes, can often ameliorate symptoms. As a high fiber and high protein food, legumes have particularly been reported to reduce the risk of diseases including coronary heart disease, obesity, diabetes, high cholesterol, or strokes [2]. If traditional foods like rice and legumes may improve disease risk, does eating them together offer any superior benefits over-consuming the items individually? One study regarding the consumption of rice and beans, specifically brown rice and colorectal cancer found a significant decrease in the amount of cholesterol while lowering the risk of cardiovascular disease by regulating lipid metabolism [1]. Another study contained an experimental group of individuals who were given a combination of either black beans and rice or chickpeas and rice compared to the control group of healthy women who were just given white rice. Researchers found that the experimental group experienced a significantly reduced glycemic response when compared to the control group [2]. This correlates to less insulin release, and therefore better long-term glucose control and reduction in blood lipids. Moreover, many scientists hypothesize that a lower glycemic response may contribute to a decrease in disease [3].

Additional research looked at the ability of beans to mitigate the negative effects of the high glycemic index of rice [2]. The glycemic index numerically represents how quickly the body converts carbohydrates, specifically glucose, into energy, [4]. White rice, for example, has a high glycemic index. This means that after digestion, the body rapidly releases sugar into the bloodstream, which then causes glucose and insulin levels to spike. Legumes, on the other hand, have a low glycemic index, meaning that the body slowly releases energy after consumption. Foods with low glycemic indices generally increase satiety and reduce rates of gastric emptying [2]. Specifically, legumes increase the release of two satiety hormones, GLP-1 and CCK, which may have contributed to the 31% increase in satiety self-reported by individuals in the experimental group compared to the control

Another study examined 17 participants with type II diabetes who were asked to consume either a combination of pinto beans and rice, red kidney beans and rice, or black beans and rice, and compared these findings to a control group that solely consumed rice. Researchers found that post-prandial (after meal) glucose levels were lower for the experimental group compared to the control group. As type 2 diabetes affects eight percent of the U.S. population and an even greater portion of minority individuals (11.8% of Hispanic individuals and 12.6% of African-Americans), knowledge of how to lower postprandial glucose levels may make culturally familiar foods increasingly accessible.

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The Leaky Pipeline: Gender Disparities in Healthcare Innovation

by Isabelle Holt, Global/Public Health Sciences and Business '22

Why is it that healthcare, one of the largest industries in the country, tends to leave women behind in its efforts to move forward? The answer to this loaded question is rooted in the educational norms that trace back to the lower school. Growing up, female role models in science were scarce. We learned from Bill Nye in class, turned to Sal Khan for homework help, and in our free time, followed Jimmy Neutron's inventions on TV. It is naïve of society to expect young girls to relate to these examples. The incongruent gender representation projected on children filters out girls from pursuing biomedical careers. As a society, we turn to the research community to advance the field of medicine and create new ways to live healthier lives; however, this community has been predominantly composed of men, causing a deficiency in healthcare innovations tailored to women and their unique health needs.

It is evident that cultural norms dampen girls' interest in STEM, and that male stereotypes are misinforming girls about what their roles in the future could be. Research has been conducted exploring children's gendered stereotypes relating to these academic disciplines. One 2006 study led by the U.S. Department of Education looked at the process of stereotype stratification and concluded that according to children, mathematicians and scientists are "nerdy" men who wear glasses. In this study, children were asked to draw a mathematician or scientist and girls were twice as likely to draw men as they were to draw women, while boys universally drew men in lab coats [1]. Children have a very skewed interpretation of who is capable of studying STEM, and this misinformation has far-reaching consequences.

These stereotypes manifest themselves further in college, leading boys to pursue degrees in STEM fields at dramatically higher rates than girls. Data collected between 2015- 2016 reports the percentage of bachelor's degrees awarded to females was higher than males, however, in STEM fields, 36% of degrees were earned by females whereas 64% were earned by males [2]. This pattern feeds into professional functioning where the gender gap grows even more. In prestigious labs throughout the country, male graduate students have historically outnumbered female students by two to one, and male postdocs outnumbered female postdocs by more than three to one [3]. Further, these esteemed labs serve as major feeders to junior faculty positions at top research institutions, leading to only 27% of research publications being authored by women in the last 60 years [4]. These statistics show how our conformation to gender norms fuels our futures. Male-dominated leadership in the healthcare industry has led to gender imbalances in clinical trials, a lack of gender-specific medicinal guidelines, and a dearth of innovation in healthcare technologies intended specifically for women.

The significant disproportion of women in science, particularly in professional-level biomedical research science, has been termed the "leaky pipeline " [5]. According to the leaky pipeline concept, there are more men positioned in areas determining the future of the healthcare industry, and therefore determining what health problems need modernizing. This means that there is a male-dominated perception of what needs in healthcare exist. The people making up this majority do not menstruate, do not use contraceptives, and do not give birth. Innovations in health including devices, tools, therapeutics, diagnostics, etc. are excluding women because there is a lack of representation of female's pain, and there are limited efforts made in the field to gain a deep understanding of complications that arise from the intricacies of female bodies. Symptoms and diagnoses that are specific to females are often regarded as exceptions to the norm, and efforts to expand this norm are limited. This leads to women's health being unstudied and underfunded. If menopause affected men, would there be medication by now?

If there were more women in positions of power in healthcare, then the industry would be able to better react to the health needs of both males and females. We need updated, equitable and holistic perspectives in positions driving the industry forward. Large corporations and investment communities are eager to get involved in the new wave of innovation that is beginning in healthcare. Companies not even remotely related to healthcare are investing in life science real estate including lab and incubator space in up-and-coming hubs throughout the country. The inventiveness in the healthcare ecosystem is disproportionately focused on making health more streamlined, accessible, and proactive. While discoveries such as genetic sequencing and biosensors certainly save lives, give people more control of their own health, and increase the overall quality of life, it is still concerning how many methods in women's health remain archaic and untouched [6].

The women's health market is gaining more attention and is preparing to undergo revolutionary changes, hopefully ridding the space of outdated procedures and tools. Reproductive health is becoming a central focus for many startups, especially because this market appeals to women of all ages [7]. Women's bodies navigate several key transitions throughout a lifetime which creates a need for specialized solutions addressing the myriad of health complications that these changes inflict on the body. Disruptive technology in women's health is needed, and it is uplifting to learn that many startup companies agree. Norms are actively changing, and women are staying in higher-up positions longer, giving rise to new role models every day. Sealing the leaks in the healthcare pipeline will be no easy fix—it will need to be repaired from the bottom up, stemming from the curious minds of young girls who understand that they are capable of anything.

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The Systemic Barriers Minority Populations Face in Healthcare

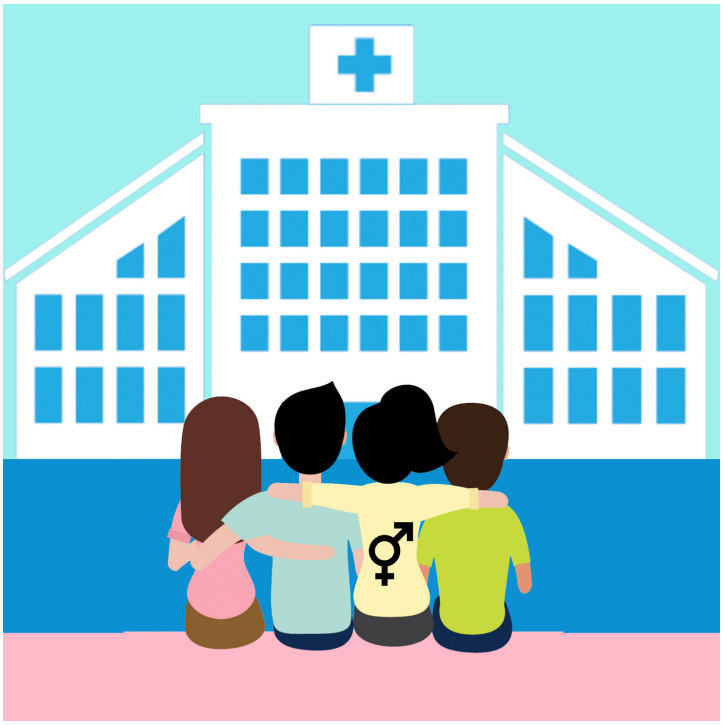
by Navya Chamiraju, Environment and Sustainability '24

While most people believe that the healthcare system provides quality care for all patients, this is not necessarily the case. Minority patients, including people of the LGBTQI+ community, have a difficult time communicating health issues and feeling safe when being treated by unknowledgeable professionals. The lack of education and resources in the healthcare system leads to poor health and more health problems such as PTSD and depression in minorities. Few actions are being taken to combat this discrimination and failure of quality in care, and education is of the utmost importance when creating an inclusive healthcare system for all minority groups.

One of the largest barriers to healthcare that people from minority communities experience is lack of access due to the professionals having insufficient knowledge of their experience [1]. There are many people of color and of the LGBTQI+ community who report discrimination in the doctor's office. Across the country, providers tend to demonstrate a lack of cultural competence towards their patients, especially transgender people of color. With regards to transgender medical care, this lack of knowledge about transgender health issues is mainly rooted in the medical training given to these professionals, which is catered to the cis, white, and male communities. This lack of knowledge and, more importantly, familiarity when it comes to treating transgender patients prevents members of the LGBTQI+ community, especially transgender members, from receiving proper care. For some people with intersex variance, interventions may have lifelong consequences such as surgical scarring, continued surgeries, or the effects of trauma linked to surgery due to the emotional impact of discrimination and stigma [2].

A member of the community recalls a specific discriminatory instance when they first received an intersex diagnosis at the age of sixteen. They had gone to a general practitioner to find out why they had not begun to menstruate. After multiple visits, bloodwork, and trips to specialists, they were told that they would not be able to have children and that their body needed a bit of a push if it were going to more adequately "feminize" [2]. This instance is not only handled poorly but also left the sixteen-year-old with emotional trauma and scarring. To reduce this barrier in the minority community experience, which is created by poor education, educational material about treating members of the LGBTQI+ community should be implemented into medical school curriculums. Biases towards minorities need to be assessed to improve the care and knowledge that providers provide and possess. This knowledge includes learning about the medical and emotional issues minorities face and how to treat them in an affirmative manner.

With this lack of knowledge comes fear and stigma against minority groups; and since the healthcare system primarily caters



Artwork by Suri Gime

cisgender people of Caucasian descent, most minorities are marginalized even further [1]. This leads to discrimination in hospitals and clinics and causes many women, people of color, and members of the LGBTQI+ community to refuse or postpone care to avoid this aggression [3]. From 2012 to 2013, studies that surveyed about 200 participants determined that transgender participants were more likely to delay seeking care and report negative effects of disclosing their identity to their provider when compared to their cisgender counterparts [3]. Women were also more likely to get delayed treatment and less comprehensive care when compared with their male counterparts because of physician biases [4]. For example, orthopedic surgeons are 22 times more likely to recommend total knee replacement to a male patient than a female patient despite exhibiting similar symptoms. Women also fail to receive further diagnoses for the same symptoms when taken to the hospital, leading to higher chances of misdiagnoses or no diagnosis at all, and thus, worse health overall [4]. This also applies to the LGBTQI+ community. The PROMIS Global Short Form, which is a carefully standardized psychometric instrument that measures the individuals' global health, showed that their overall physical and mental health status was deemed lower than the average person due to delayed care.

Many members of the LGBTQI+ community face major depressive disorder (MDD) or posttraumatic stress disorder (PTSD) due to stress from the prejudice, social stigma, and discrimination they face [5]. This stress can also exhibit in physical forms, which is

usually ignored or pushed off since going to the professionals causes extra stress due to their minority status. To cope with the mental and emotional stress that many minorities experience, about 30% of transgender participants in a nationwide survey noted that they resorted to the use of drugs and alcohol [6]. Male participants had an easier time receiving help for their addiction and other issues while minorities, especially transgender participants, were denied services or postponed medical treatment due to LGBTQ-related discrimination. Addictions tend to have a greater effect on minority communities as the resources and education related to these issues are limited [6]. Unfortunately, there has been no meaningful attempt to educate or alter the workforce to cater to the needs of different minority groups including transgender individuals [1]. Due to these limited efforts, it is more difficult for minority groups to feel comfortable and reach out for help from healthcare professionals, which only puts them at a disadvantage mentally and physically. This also leads to postponing medical services leading to health issues worsening at a faster rate in minority groups compared to others [5].

A few different courses of action are helping to actively combat discrimination against minorities in the healthcare system, from individual action to broader change influencing healthcare systems. There are many transgender patients who decide to take matters into their own hands and personally educate their providers on their specific needs [5]. This results in catered care for the individuals if the professionals are willing to cooperate, but does not create institutional change. For a wide-encompassing change, the Gay and Lesbian Medical Association produced Guidelines for Care of Lesbian, Gay, Bisexual and Transgender Patients in 2014 [5]. These guidelines are meant to be used by primary care health care providers and include recommendations for staff sensitivity training. As of now, there is no current information on the efficacy of these guidelines. However, with the implementation of this and other similar programs, nation-wide change can occur, providing a safer and more inclusive space for minorities, especially transgender patients.

Minority populations, in general, have limited access to healthcare services. Subgroups such as transgender and queer populations within the LGBTQI+ community are especially vulnerable to experiencing discrimination and microaggressions based on their identity. These issues inflate the health disparities that minority communities experience and act as a hurdle towards optimizing their health and well-being. Creating a safer space for minority patients is of utmost importance, but requires comprehensive education of the healthcare workforce.

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Water Scarcity on Navajo Nation Worsens COVID-19 Disparities

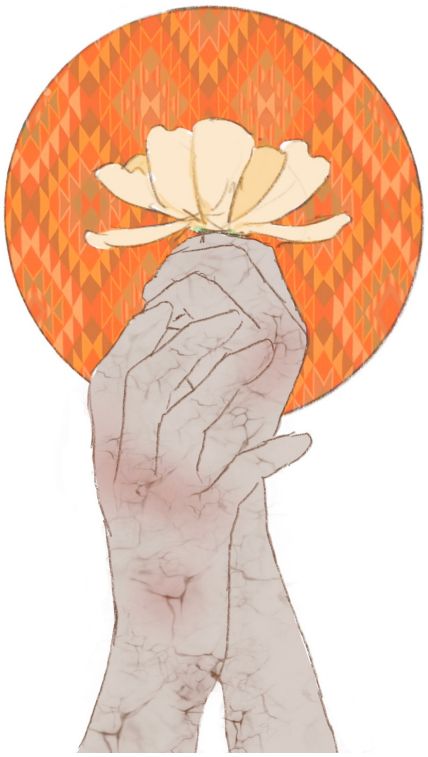
by Francesca DiGiorgio, Masters of Public Health '22

Widespread water scarcity is exacerbating the impact of COVID-19 on members of the Navajo Nation. As of 2021, one in five of the territory's residents—an estimated 37,000 people—lack access to running water or indoor plumbing [1]. Poor sanitation infrastructure coupled with recurring droughts and water contamination [2, 3] have created barriers to hand-washing and the ability to follow other CDC guidelines intended to reduce virus transmission [4]. Therefore, addressing the systemic challenges that limit access to clean water for Navajo residents will be essential to reducing the morbidity and mortality of Dikos Nitsaaigii Ndhast'eits'aadah, or "Big Cough 19", within this population [5, 6].

While communities of color across the United States have shouldered a disproportionate burden of COVID-19 cases, hospitalizations, and deaths, the overrepresentation of these among Non-Hispanic American Indians and Alaska Natives (AI/AN) is especially profound. According to a report from the CDC, AI/AN persons comprise just 0.7% of the U.S. population, but account for 1.3% of laboratory reported infections nationally [7]. Moreover, AI/AN persons have experienced 3.5 times higher cumulative incidence of COVID-19 and 1.8 times higher mortality compared to non-Hispanic whites [7]. In the Navajo Nation specifically, COVID-19 cases per capita surpassed those of all other states in the country by early summer [8]. As of April 2021, more than 10% of the territory's population has tested positive, although actual numbers are likely to be higher, given that AI/AN health statistics are chronically underreported [4, 7, 8].

Health disparities observed among AI/AN groups largely stem from structural racism and discrimination [9]. For example, a 2019 report from the U.S. Water Alliance identified race as the strongest predictor of water access in the country. Compared to whites, Black and Latinx households are twice as likely and AI/AN households are 19 times more likely to lack access to indoor plumbing [10]. The Navajo water crisis, in particular, can be linked to federal policies from the 19th and early 20th century that relegated these tribes to the Southwest, which is among the driest regions in the country [9]. To cope with recurring droughts exacerbated by climate change, Navajo residents are reducing their household water consumption to between two and three gallons per day. In comparison, most American households use about 88 gallons per day [9].

As underdeveloped infrastructure and chronic underfunding for improved water sources persist across the territory, the U.S. government has offered minimal support [9]. Consequently, Navajo residents often haul water from unregulated sources, such as livestock wells and natural springs, which are not routinely tested in accordance with the Safe Drinking Water Act [3]. These unregulated water sources are susceptible to bacterial contamination and sometimes exceed standards for uranium and other chemicals, which poses serious health risks to the population [3].



Artwork by Keona Moya

To address water scarcity challenges during the pandemic, the Indian Health Service (IHS) has partnered with the Navajo Nation and other organizations to implement the Navajo Safe Water project. Using the $5.2 million in IHS support received from the Coronavirus Aid, Relief, and Economic Security (CARES) Act, the project aims to improve clean water access by installing temporary water access points, paying associated water fees, and supplying water storage containers and disinfection tablets [1]. Funds will also cover outreach efforts to increase public knowledge of these services [1].

Since its roll-out in late 2020, the project has achieved modest success. For example, residents report that the distance traveled to access water has decreased from an average of 52 to 17 miles, with a drive time savings of 38 minutes [1]. While these short-term solutions represent progress, rough terrain and sparse population in many areas impede traditional piping and pose challenges to long-term water access [3]. According to IHS estimates, expanding safe drinking water and basic sanitation to all Navajo homes will cost over $700 million [3].

In the meantime, grassroots efforts such as THE WATERED: Water Acquisition Team for Every Resident & Every Diné, are supporting sustainable solutions at the community level [11]. Founded by Navajo resident Yoland Tso, THE WATERED builds and delivers fully portable washing stations to those in need, free of charge [11]. The hands-free technology is powered by a foot-pedal in order to reduce transmission risk and also comes with liquid hand soap, a five-gallon water reservoir, storage container, and two wheels for portability [11]. According to an interview with Tso, the station's design is intended to optimize safety and accessibility, especially for the elderly or those with disabilities [12]. To date, THE WATERED has installed over 100 hand-washing stations, providing over 300 families with clean water access. The organization plans to build an additional 150 stations using funds secured through a GoFundMe campaign [12].

While no single solution exists to close the water access gap in the Navajo Nation, raising awareness of its linkage to systemic racism is a critical first step. By empowering Navajo leaders through increased financial resources and leveraging political will through media coverage and advocacy, we can support capacity-building for more sustainable water systems managed by and for indigenous communities. Such efforts, coupled with additional attention to housing, healthcare, and other social determinants of health can help mitigate the disparities observed during the COVID-19 pandemic and improve Navajo resilience to future crises.

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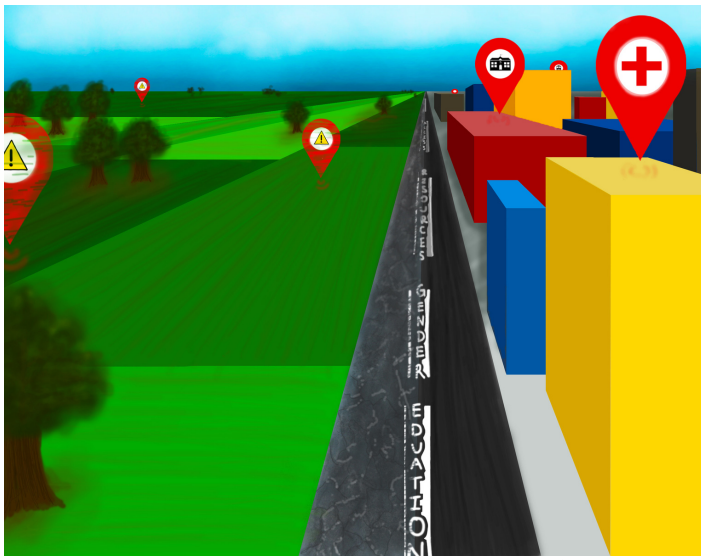
Can Your School Impact Your Health?

by David Rusakow, Biological Sciences '22



Artwork by Caroline Mendoza

As a Cornell student, it can be easy to lose oneself in the intellectual ivory tower. It is sometimes hard to fathom that not everyone in America has a college degree, knows about DNA polymerase II, and can choose their favorite subject to study in school; but venture beyond campus and this illusion quickly fades. Even in the town of Ithaca, one can begin to see public health crises that mar much of the American populace: substance abuse, inadequate nutrition, and more. Of course, many of these problems are inherently tied to socio-economic status, there is no avoiding that. Nevertheless, these health issues also stem from educational disparities.

The education situation in America is much different from most people's preconceived notions. Indeed, the numbers are staggering. In 2019, only 39% of American adults held a bachelor's degree [1]. As America pushes towards a one-size-fits-all approach to education with the desire for universal college, it's important to ask: how does an individual's education affect health outcomes?

Education and socioeconomic status are extremely intertwined which makes it difficult to pinpoint whether education has a causal effect. Yet, an increasing number of statistics reveal the dramatic influence of education on health.

First, one must consider how a patient's educational background can create difficulties during a visit to the doctor's office and understanding of a treatment plan. The fact is that "fewer than half of US patients have the necessary skills to read and follow drug label instructions, respond to insurance forms, provide a patient history or communicate effectively with a physician, according to an NIH study" [2]. This is perhaps the bleakest of all statistics, as it suggests that no matter how much doctors try to improve patient health outcomes, a patient's poor education situation may prevent them from obtaining the best health care.

How is someone supposed to receive treatment if they cannot explain their problem to the physician, fill out the paperwork to pick up their medicine, and follow its instructions?

Then, there is the matter of difference in how physicians treat patients based on their education level. Studies have shown that patients with high school education and below spend more time being examined and counseled on nutrition, and less time on having their questions answered, health knowledge assessed, and being counseled on the importance of exercise. What's more, less educated patients receive fewer screening tests [3]. Surprisingly, these patients have similar overall visit satisfaction. These studies convey a concerning trend: lesser-educated patients may not realize the care that they are missing out on.

Perhaps the most shocking finding is that those with lesser education are not only receiving different care at the doctor's office, but they are also leading shorter lives. Studies have shown that for individuals born in the U.S between 1914 and 1939, only one additional year of schooling decreases the chance of dying by 3.6% [4].

Not only are they living shorter lives, but in the time they do have, they are also less healthy. [1] Studies show that, in general, individuals who completed higher education have a greater chance of being in good health than those who did not [5]. This can be due to a host of personal factors. For example, better-educated people are more likely to hold better jobs with fewer health risks and superior health insurance coverage [6]. Similarly, they are more likely to have less stress and fewer resources to fight off stressful situations like financial means, strong social support, and self-esteem, etc. Then, there are the clear socio-economic matters, like the fact that the higher income that corresponds with higher education means individuals can more easily purchase healthy food, afford a doctor's visit, and have time to exercise regularly [6].

Unfortunately, these issues are not only limited to this generation [2]. Studies have shown that for women at the brink of college enrollment, being able to attend for two years decreases the risk of smoking during pregnancy from 7.8% to 2% [4]. These deleterious health outcomes will be passed onto the next generation when individuals are unable to pursue higher education.

In short: more Americans need higher education. Beyond the obvious socio-economic benefits, the studies highlight the improved health outcomes we can expect. As to how the higher education rates can be improved, it is not for me or anyone else in academia to decide. Our concern should be bringing awareness to this issue via advocacy and supporting studies that continue to underscore the importance of ensuring everyone receives a college degree because its effects extend beyond the job market and into a healthier America both now and later.

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Healthcare in the Child Welfare System

by Riya Patel, Policy, Analysis and Management '24

In society, there are a few aspects of life that most agree are fundamental to individual well-being, one of those being health. It is connected to all other foundations of society, whether that be education, family life, or place of residence. However, we tend to think that the health of young people is inconsequential since pediatric diseases and other chronic conditions are not as common. By assuming that children are healthy, many children that need appropriate care to establish a solid foundation of health are ignored. One group that has faced the brunt of this inequality is children in the foster care system.

A vast majority of youth in foster care are eligible for Medicaid through Title IV-E eligibility. Title IV-E is a part of the Social Security Act and provides funds for foster care [1]. Medicaid provides many benefits for these children. Medicaid's Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) covers care such as screening services, behavioral health services, psychotropic medications, and reproductive health services [1]. Such services are essential; a 2015 American Academy of Pediatrics article states that a third of foster care children come into the system with a chronic condition [2]. Despite how expansive the Medicaid coverage may seem, there are challenges. As noted in 2015 by the Medicaid and CHIP Payment and Access Commission, when children switch between homes, health conditions can go untreated, and duplicated services may arise if providers lack access to medical histories [3]. Behavioral health services are especially important; a 2016 study by Pediatrics highlights that children in foster care are 6 times more susceptible to behavioral problems [4]. However, the 2015 Medicaid and CHIP Payment and Access Commission report points out the vulnerability of foster care youth to unnecessary psychotropic prescriptions [3]. Although the Child and Family Services Improvement and Innovation Act of 2011 mandates that states keep track of psychotropic prescriptions for foster care children [1], more accountability is necessary so that appropriate health care is provided and needs are satisfied.

Those who age out of foster care are also impacted by policies. They represent an important subgroup, former foster care youth, that are often neglected. If we cannot ensure that a child under the care of foster agencies receives proper and substantial assistance, then when that child leaves and ages out of the system, the foundation of health care is weak. Of course, prioritizing the health care of children in the system is important, but ensuring that those same children have adequate resources once they age out is equally necessary. For most former foster care youth, access to Medicaid continues until age 26, as long as they were in foster care up until 18 years of age (or the maximum age you can receive federal foster care) and were enrolled in Medicaid while in the foster care system [5]. This sounds great in practice, but as discussed in a 2018 Kaiser News article, many are concerned that former foster care youth may not be aware of this health coverage extension, leaving health conditions untreated [6].

Untreated health conditions, whether physical or mental, are dangerous to a child's health, and can also affect other aspects of their life, such as education, possible employment, and overall well-being.

Clearly, there are two groups whose health care concerns need to be addressed: those that are in the foster care system and those that have aged out. Medicaid should increase reimbursements to providers of mental health services so that children have a more expansive and accessible network of providers that are willing to treat mental health conditions. Medical schools should increase mental health training in their curriculum so that providers are more equipped with the knowledge to appropriately guide these youth towards better health. This could also help diminish the inappropriate prescriptions of psychotropic medications. It is also important that data and medical histories are more accessible to providers so that health care needs are met. For those that age out of the system, there should be more educational campaigns centered around increasing awareness for former foster care youth that health care access still exists. Foster care agencies and local health care organizations should be involved in such campaigns for maximum effectiveness.

Fundamentally, the foster care system is so much more than helping children who do not have a safe nor stable home. These children have a lot of trauma and health conditions that need to be treated seriously. The goal of the system is to provide care. Better health care in and out of the system will create a stronger foundation for these youths, which is a necessary step in improving well-being. Health care policies must keep this intention in mind.

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Race-Based Medicine: Scientifically Unfounded Clinical Practices and Their Impact

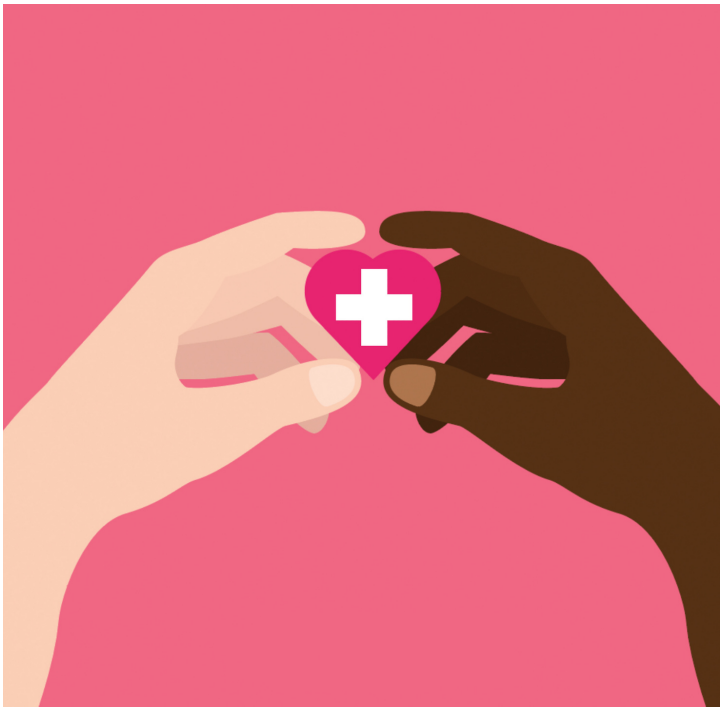
by Julianne Franca, Biology and Society '22

While medicine is often regarded as an objective field focused on using evidence-based approaches to improve patient outcomes, race-based medicine, in which race is seen as a genetic variable that must be accounted for in the clinical setting, produces discriminatory methods of care that lack objectivity and scientific backing and harm patients. Physicians use race-based medicine to make estimations and adjustments based on self-reported racial identity when testing and diagnosing patients. When examining the origins of race-based medicine it becomes clear that it is rooted in social and cultural biases rather than scientific claims. These practices are implemented in a variety of clinical contexts making erroneous assumptions about the health statuses of patients of color which are both harmful and discriminatory. The harsh reality is that although objective evidence suggests that no basis for race-based medicine exists, physicians continue to incorporate these practices, resulting in poor health outcomes.

It is a common assumption that science and its applications in medicine are rooted in accurate and objective research. However, when it comes to incorporating race into medical care, that expected objectivity is not met. Large-scale genomic studies have shown that 99.9% of the human genome is essentially the same, and the 0.01% of the variation in the human genome is not due to racial differences [6]. Despite the evidence disproving genetic differences between races, medical professionals still accept race as an indicator for a variety of conditions such as reduced lung capacity and an increased risk of stroke [5]. Dr. Dorothy Roberts, a critical race theory scholar, discusses how the spirometer, a device used to measure lung function, has a race setting to correct for presumed lower lung capacities of black patients. She explains that this assumption dates back to a pre-Civil War physician who claimed that African Americans had innately lower lung capacities as a justification for slavery [4]. Further, Noor Chadha et al. along with researchers from the Institute for Healing and Justice in Medicine and the Othering & Belonging Institute connect these discriminatory practices to a longstanding history of racism and eurocentrism in medicine [2]. They link the ideologies behind race-based medicine to the prominence of eugenics in the twentieth century which equated racial difference with genetic variation, with people of color often seen as genetically inferior [2]. Racism has evidently infiltrated science throughout the history of medicine, and it continues as these beliefs perpetuate the conflation of race with genetic variation.

This unfounded conflation of race with genetic variation has contributed to a variety of racially targeted treatments and medical practices. A prominent example of this practice is BiDil, a treatment for chronic heart failure that was approved by the FDA specifically for patients who self-identify as African American [4]. While the trials for BiDil showed a 43% reduction in mortality, it was only tested in African Americans and lacked a comparison group demonstrating the drug is not beneficial for other populations [2]. Further, the MDRD glomerular filtration rate equation is adjusted to produce higher estimations in patients who identify as African American than in white patients with the same creatinine levels due to an assumption that African Americans have more muscle mass [4]. Some laboratories have started making a switch away from GFR calculations that include race, and there is research being done to determine less discriminatory and more accurate methods [3]. However, most laboratories still include race as a factor in their calculations [3]. Although the sources being discussed describe the use of and reasoning behind making medical corrections and assumptions on behalf of race, the rationals remain scientifically unfounded.

The clinical applications of these scientifically unfounded practices and assumptions can lead to deleterious consequences. Discussing BiDil, Dr. Roberts explains the dangers of racially targeted medicine, highlighting their implication that "black people's bodies are so substandard, a drug tested in them is not guaranteed to work in other patients" [4]. Further, there is evidence that these practices produce a variety of negative health outcomes. For example, the idea that African American patients have inherently higher levels of certain compounds, higher risks for renal failure, and even stroke can lead to the delay of life-saving interventions [5].



Artwork by Suri Gime

Medical anthropologist Dr. Jessica Cerdeña et al. propose race-conscious medicine as a possible alternative that eliminates racial

assumptions and instead produces estimations based on social factors that influence health [1]. This approach would improve health outcomes by eliminating incorrect assumptions about genetic variations between races and emphasize the real cause of health disparities which Dr. Roberts cites as social inequality [4]. While Dr. Cerdeña et al.'s proposal seems like a step in the direction of scientifically-backed medical practices, Sandra Soo-Jin Lee, an anthropologist at the Center for Biomedical Ethics at the Stanford University School of Medicine, wisely explains, "I think that science is deeply embedded by the social values and the historical and political environment in which it is conducted" [6, 248]. Therefore the difficulty in adapting to proposals such as the one made by Dr. Cerdeña et al. is likely rooted in clouded judgment caused by a deep history of racial discrimination and assumptions of difference that have infiltrated the medical field. It is likely that further research disproving these outdated methods and a greater sense of social awareness in the medical field is required before a transition to racially conscious medicine is made and for the discriminatory practices of race-based medicine to be overcome.

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Cancer and Stigma: Behind the Perils of Misconception

by Jerome Dovan, Human, Biology, Health and Society '23

In a branch of medicine where the difference between life and death can be marginal, Dr. Vu, a hematologist oncologist, is often the bearer of bad news. "The initial patient reaction [to a cancer diagnosis] has a sense of doom and hopelessness and therefore potential isolation" (Dr. Khai Vu, personal communication, March 28, 2021). In these situations, it is impossible to avoid the bad news. However, misinterpretation of a diagnosis can be consequential, with stigma being a key example.

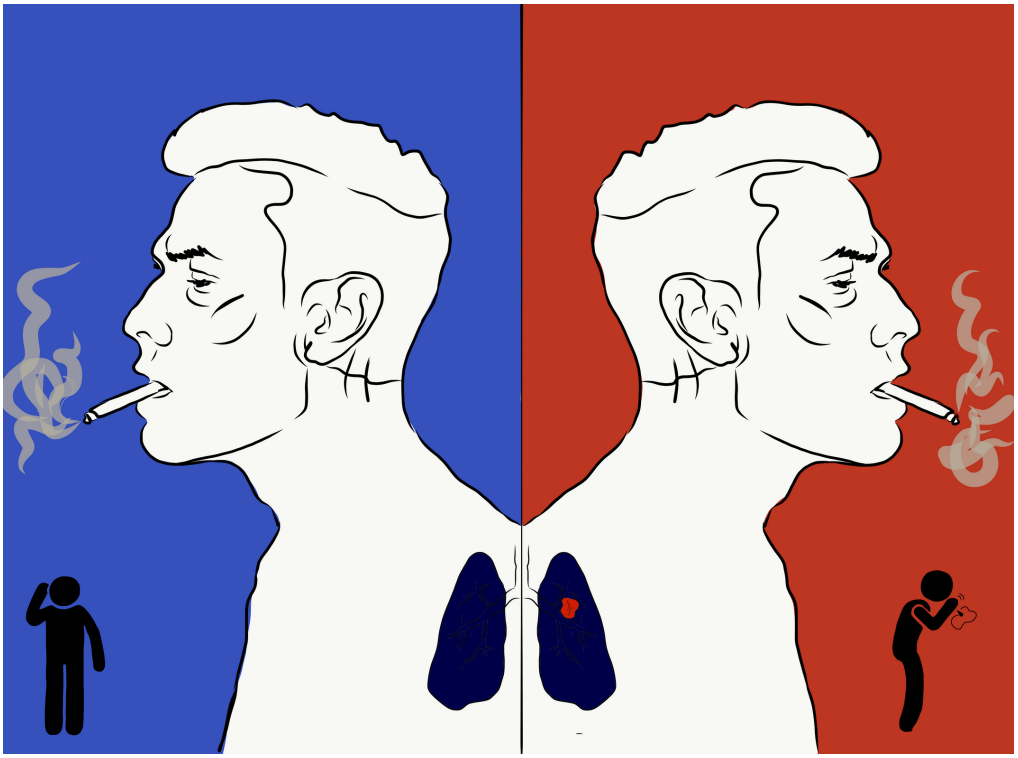
Stigma can be defined as a mark of shame or lack of acceptance of individual experiences based on qualities or traits deemed undesirable by society. Within the context of mental health, the role of stigma can be crushing, often leading to social exclusion, weak support networks, and low self-esteem [1]. The fear of publicizing one's condition can extend these consequences further as patients are hesitant to seek health care or consent to treatment. Stigma, however, is certainly not isolated to mental health, but also exists within a wide range of health conditions, including cancer.

The prevalence of stigma within cancer patients can diverge significantly across the disease's many forms. For lung cancer patients, this stigma may appear as the manifestation of guilt due to the high association of their condition with smoking. Cervical cancer patients, on the other hand, may feel shame, believing that society will blame their condition on their sexual history [2]. In many of these cases, the threat to one's identity stems from a seemingly irrational perception of how society judges individuals.

Yet, it is possible that these individuals' intuitions are not without reason, as recent findings demonstrate particular biases in society's views towards cancers.

Notably, two key factors that determine the level of stigmatization of different types of cancers are perceived controllability and visibility. The first factor is perceived controllability, or when a condition is considered controllable based on an assigned causal attribution. A clear-cut example can be viewed in the context of lung cancer, as a study conducted to understand the role of stigmatization in health conditions found that participants were more willing to allocate funding to breast cancer targeted programs compared to lung cancer targeted programs [3]. Upon further inquiry, participants revealed that their decisions were strongly influenced by the extent to which they believed their respective condition was controllable.

Visibility is another key determinant in the level of stigmatization. Often, this is simply due to an individual's visual qualities that potentially could reveal signs of a cancer condition. Some examples may range from cancers of the neck or face involving discoloration and bumps to alopecia (balding) as a result of chemotherapy. Within all of these cases, these visual indicators can point out associated health conditions to peers which takes a consequential toll on one's self-esteem and self-perception [4].



Artwork by Jack Waldman

One study observing cancer patients immediately after chemotherapy (without hair) found that 73% of patients did not feel as self-confident as they had been before chemotherapy [5]. Moreover, close to 47% of the participants listed alopecia as the most traumatic effect of chemotherapy. Clearly, stigma is heavily characterized by one's expectation of how he or she is viewed by society.

Understanding the consequential effects of stigma on cancer patients cannot be understated. For cancer patients, learning of a diagnosis while holding onto stigma and misunderstanding may affect the treatment they are willing to undergo, as well as the extent of isolation they experience from work and everyday life. For example, there is a documented under-utilization of health care services for lung cancer patients due to a fear of associated blame, shame, and even discrimination [6]. In other health conditions, such as schizophrenia, highly internalized stigma has a strong association with negative attitudes and adherence to treatment [7]. Some patients will seek alternative medicine on their own, which puts physicians, who are tirelessly prescribing evidence-based treatments, in an uncomfortable position. In terms of their daily lives, patients may struggle to return to work after a prolonged, medically related absence. Some patients will opt to keep their cancer a secret from coworkers and peers or seek new employment completely [8].

As the stigma associated with cancer becomes more apparent, it is critical to ask how we can go about minimizing its destruction on patient's lives. Because significant misconceptions exist within different communities, providers must ensure a mutual understanding of the causality and prognosis of cancer [6]. The most important strategy is to promote clear communication between doctors and patients: "Like any problem [a patient] encountered before, they can effectively deal or cope with [cancer] by understanding and getting a handle on the problem, which then gives them the insight to make a plan moving forward" (Dr. Khai Vu, personal communication, March 28, 2021). In addition, research has revealed that patients find one-on-one or small group sessions to be particularly efficacious for support.

Patients most highly rated sessions where the group was limited to patients with the same diagnosis and where there was an emphasis on treatment insight and self-care [9]. Simply stated, patient education is key to diminishing stigma from a cancer diagnosis, and alleviating the burden an individual patient faces: "Helping patients relate to their cancer diagnosis as a problem they can realistically deal with, similar to other challenges they previously have had in their lives, lessens the severity of the stigma" (Dr. Khai Vu, personal communication, March 28, 2021).

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The Scary Reality Behind Renting a Womb

by Jisoo Ha, Policy, Analysis and Management '23

Pregnancy is a beautiful process that leads to new life; however, not all pregnancies are so delightful. Surrogacy, now a multi-billion dollar industry in the U.S. [1], is a transaction in which a woman carries a baby for another woman who cannot carry babies themselves. Clients for such a service include same-sex couples, women without wombs, and women at risk for pregnancy-related complications. On the surface, surrogacy is not ethically concerning. However, when digging deeper, exploitation of the poorly regulated service is evident as surrogate mothers rent their wombs without being informed of the hazards.

Despite the practice rising in popularity, the U.S. still lacks national regulation around surrogacy. A 2016 CDC report estimates that 18,400 surrogacy babies were born between 1999 to 2016, though the actual number is likely to be much higher given the rise in popularity and lack regulation around surrogacy [2]. Most surrogate mothers contract with agencies, which may greatly profit from drawing more women in by dismissing the psychological and physical dangers of surrogacy.

On average, surrogate mothers in the U.S. are paid $20,000 to $25,000 per pregnancy. This boils down to around $3 per hour the surrogate mother is pregnant or in labor, which is far less than the national minimum wage of $7.25 [1, 3]. Still, the seemingly high payment deceives low-income women, particularly military wives as surrogacy is an attractive and viable option to double a traditionally low income. Furthermore, they are considered to be "easy recruits" to surrogate agencies, since they have a pre-existing service mentality stemming from sacrifice and loyalty to the nation. Military wives are further assumed to be celibate while their husbands are stationed overseas and have few legal protections, increasing their odds of being exploited for surrogacy. As a result, many surrogacy clinics are located near large military bases, such as Texas, California, and Florida [2].

Despite the financial incentives associated with surrogacy, one should not overlook the risks. Due to the high cost of surrogacy, multiple embryos are implanted at once with the hope of successful implantation, which increases the risk of C-section and perinatal complications such as gestational diabetes, fetal growth restriction, and pre-eclampsia, as well as premature birth [4]. Director of the documentary *Breeders: A Subclass of Women,* Jennifer Lahl, recalls that one surrogate mother almost died due to high-risk pregnancy complications [5]. Lahl further remembers surrogates who suffer from post-traumatic stress disorder after their surrogacy [5].

Additionally, surrogate mothers can rarely choose the environment they think will best fit the child. Former surrogate mother Melissa Cook was carrying triplets for a father who wanted to abort at least one child because he could not afford them all [6]. After her children were born, the custody was given to the father, who left the children unattended for extended periods of time. She fought for custody but was denied at lower courts due to the contracts signed; however, Cook stated, "there are rulings that have to be made [when dealing with a child's life" [6]. Along with Cook, two other surrogate mothers have filed and called on the Supreme Court to enforce stronger regulation for the rights of surrogate mothers and children. They state that surrogacy contracts are abusive by "creating a class of women as breeders" and are "commodifying children" [6].

Surrogates are not only denied the right to express their beliefs and endure the physical implications of pregnancy but are also emotionally burdened. A personal testimony of a young surrogate mother demonstrates the hardship of giving up a child: "While grappling with the emotional rollercoaster of saying goodbye to my newborn baby, I realized...it was impossible for me to know exactly what I would be going through during pregnancy and what I was giving up post-birth" [7]. Pregnancy is an emotional investment for any mother, including surrogates. A 2014 case study of eight surrogate mothers revealed that these women experienced significant emotional attachment to the children they knew they would be giving up after the delivery [8].

Along with all the aforementioned obstacles, surrogate mothers also face financial struggles. Agencies leave surrogates with a "hefty financial burden" by not defending them when a conflict of unpaid medical payments arises [5]. For instance, a five-time surrogate mother from South Dakota shares that the expecting parents took the child and left her with thousands of dollars in unpaid medical bills [5].

Like their carriers, surrogate children are also at emotional risks. A report published in the Journal of Child Psychology and Psychiatry found that children raised by non-birth-giving mothers face increased psychological adjustment issues such as depression [5]. Moreover, children born through surrogacy are more likely to be of low birth weights or be stillborn [5]. These children also suffer serious genealogical bewilderment as young adults, an identity problem experienced by children who are fostered, adopted, or conceived from surrogacy. To exacerbate the situation, children of surrogate mothers have no access to information about their potential biological siblings, which further induces stress [5].

The serious ramifications of surrogacy deserve to be voiced in order to minimize the exploitation of women who might consent to the surrogacy transaction without acknowledging the potential risks and hidden injustices. While surrogacy is often brushed over as an altruistic act for a couple who cannot carry a child on their own, its reality is often characterized by health risks to the surrogate mother and child. Attention to this issue is needed, and national policy surrounding surrogacy should be implemented to protect women who might otherwise be conned into "renting" their wombs.

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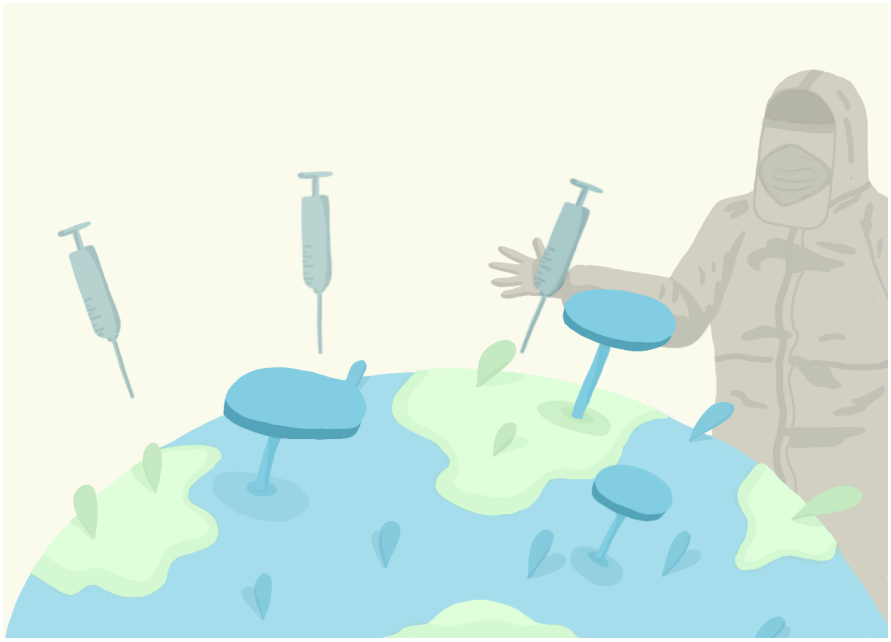
Medical Mission Trips by Ronya Strom '22

The Arrival to the New Normal by Kaylah Nicholson '24



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Childhood Mental Health
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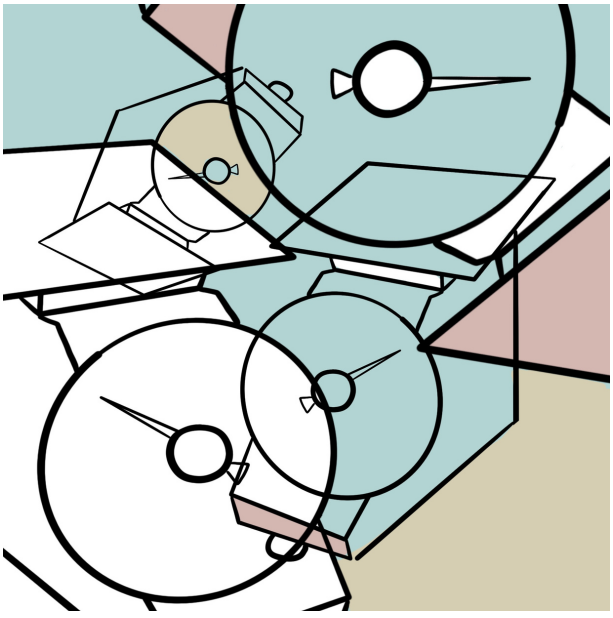

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