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Coronavirus: A Brief Overview By Dr. Maria Rahman MPH '21



The coronavirus, which was first discovered in December 2019 in Wuhan, China, has transformed the world, including the United States [1]. Americans now face a reality that includes widespread panic, empty streets and sidewalks, locked businesses, travel bans, government-issued shelter-in-place orders, above-capacity hospitals, and thousands of infections and deaths, all from a mysterious respiratory virus [1]. Just a few months ago, this combination of events would have seemed to be the storyline of an apocalyptic film, but it is now an everyday reality.

How does the disease spread?

According to the Centers for Disease Control and Prevention, COVID-19 is a disease that is spread primarily through respiratory droplets [2]. The virus is more specifically known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and is a single-stranded RNA virus of the genus Betacoronavirus [3].

Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV) are previous strains of Coronavirus. One genetic sequencing analysis found that SARS-CoV-2 is approximately 89% similar to SARS-like (SL) Coronaviruses originating from bats, while it is about 79% similar to SARS-CoV and only about 50% similar to MERS-CoV. [3]

Based on sequencing and analysis of SARS-CoV-2 genes from cases in Wuhan, China, the likely transmission of the novel Coronavirus was animal to human. According to this study, the first case may have been caused by bats or bat feces that polluted the markets or the part of Wuhan, China where the outbreak first began [3].

However, a more recent analysis of the SARS- CoV 2 genome found that a spike protein coded for in the SARS-COV-2 genome is 91% analogous to a comparable protein sequence found in the lungs of sick pangolins, a scaly animal similar in appearance to an anteater. The pangolin genome sequence study states that "the receptor binding domain of the spike protein from the pangolin coronavirus had only five amino acid differences from SARS-CoV-2, compared with 19 differences between the human and bat viral proteins." Researchers claim that the nearly identical nature of the proteins indicate that pangolins are the most likely the intermediary hosts between bats and humans, but other hosts remain plausible [4]." This indicates that pangolins may have been a vector for the transmission of the disease from bats to humans.



How fast is it growing?

Early studies of the January 2020 COVID-19 Mainland China revealed that new COVID-19 cases followed a pattern of exponential growth [3]. The mean reproductive number, known as Ro, based on these early Mainland China SARS-CoV-2 cases, was found to be approximately 3.0 [2]. Ro, pronounced R naught, is a statistical term that describes how contagious an infection is. An Ro of 1.0, for example, indicates that each infected person transmits the virus to on average one other person. A Ro value greater than 1.0 indicates that the infectious disease will spread and can cause an outbreak or epidemic. The Ro value needs to be brought to less than one to control an outbreak, but this can be challenging because of "super spreading," which occurs when one person transmits the virus to tens or hundreds of people, such as at a large gathering like a funeral or religious service [5].

The Ro ranges for comparative viral infectious diseases include: Ebola, 2014 [1.51 to 2.53], H1N1 Influenza, 2009 [1.46 to 1.48], Seasonal Influenza [0.9 to 2.1], Measles, [12 to 18], MERS [~1], Polio [5 to 7], SARS Pandemic [<1 to 2.75], and Smallpox [5 to 7]. The accuracy of the estimated Ro value for SARS-CoV-2 remains uncertain due to the possibility of a large number of missed cases and lack of a complete understanding of SARS-CoV-2 and its infectivity [6]. The incubation period and doubling time of the virus were both found to be 6.4 days. It is also probable that a portion of the spread of the novel Coronavirus resulted from infected, but asymptomatic individuals who transmitted the virus to others [3].

What are the symptoms?

The most common clinical signs of infection are fever (92.8%), cough (69.8%) and shortness of breath (34.5%). Nasal discharge (4.0%) and sore throat (5.1%) were less commonly found. The outcomes of the infection are varied and can include ICU stays, ventilator requirement, shock, acute respiratory distress syndrome, acute renal injury and death [3].

How can it be prevented?

According to the World Health Organization (WHO), the best way to prevent COVID-19 is to consistently maintain clean hands by using an alcohol- based liquid or gel or washing hands with soap and water. The World Health Organization also suggests "social distancing," which is the practice of keeping distance between yourself and others, especially from persons that are coughing or sneezing. The WHO also suggests avoiding touching your eyes, nose and mouth, coughing and sneezing into a tissue or bent elbow to prevent the spread of droplets and staying home if you feel ill. If you develop severe illness, which includes fever, coughing and shortness of breath, then the WHO suggests that you contact your medical provider [7].



What are the societal impacts of this pandemic?

Along with being one of those most devastating Public Health crises in our lifetimes, this pandemic has also altered personal lives. Social distancing has kept most Americans home for weeks and has the potential to continue for several more weeks to months. Even when it is safe to have contact with others again, there could be a lasting impact of these new social norms — people may begin to avoid personal interactions more often, including shaking hands, in-person meetings, and even collective religious worship. Experiencing this pandemic may also lead to more Americans questioning the hyperindividualism that was so prevalent in the US before, since it is now clear that our lives are more connected than we might have previously thought. This realization could have many societal impacts, including further investment in public goods and services,

reform of the US healthcare system, a shift to holding more services over the internet, increased use of telemedicine, and political and community support for a public funding of child and elderly care [8]. In short, the world we will return to when self-quarantine and social distancing ends may not be the same world we left.



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Racist is the Head that Fears the Crown By Consuelo Le '22

"Every disease ever... came from China," yelled a drunk, ignorant man on the Los Angeles subway on February 1st, 2020, apparently forgetting that the biggest outbreak of influenza in history originated in Central Kansas. Tanny Jiaprapasuke, the recipient of this angry outburst, was taking the train home with a friend. The man continuously gestured at Jiraprapasuke, claiming that "[Chinese people] are f***** disgusting! They [claim to] be so smart...you can't even wipe your ass." At that moment, Jiraprapasuke, who is actually Thai-American, was struck with the realization that the entire Asian community was under attack for something that was not their fault [1,2].

This is not the first time that Asians have been wrongfully judged for transmitting a disease. In 1900, when the Third Plague Pandemic of bubonic plague swept through Asia and made its way to California, American society vehemently accused the Chinese population in San Francisco's Chinatown for bringing the plague to the West Coast, forcing them into crowded isolation rooms and refusing to treat them [3]. In reality, the bubonic plague had snuck its way into the United States through an infected rat on a ship, which ran off in a Californian port and began to spread the disease. Nevertheless, Americans jumped to blame Chinese people, who were already the subject of racial prejudice on the west coast for immigrating to America in large numbers. Unfortunately, even though 21st-century society publicizes and condemns discriminatory attacks, the rise of racism with the coronavirus has demonstrated that fear continues to feed prejudice, even today.

The current coronavirus outbreak began in late 2019 and started to catch the American media's attention in January of 2020. Since then, fear and panic have spread rumors about its origin and who is responsible for it. Despite the hoard of people pointing fingers at the Chinese population, it is not about "who" is responsible, but "what." Recent research published in the scientific journal Nature suggests that this particular strain of coronavirus is zoonotic, or transmitted from animals to humans — and in particular, from a specific bat found in the Yunnan province in China. Although the study showed that the genetic material of the bat's virus was 96% similar to the current human strain, it was suggested that the animal strain had actually been transmitted to an intermediate host before infecting a human [4]. Thus, the idea that a Chinese person is to blame for the 'rise' of the virus is false; the "fault" instead lies with an unfortunate bat.



However, we know from human experience that fear often trumps fact. People feel the need to find a solid cause to their problems so as to project their frustration onto it, even if it means blaming the innocent. Currently, verbal and physical xenophobic abuse runs rampant throughout America and the world, as seen through Jiaprapasuke's story. Although such racist outbursts may feel distant to college students, coronavirus-related discriminatory threats and actions have also been occurring on college campuses — especially at schools with a larger population of Chinese students, such as Cornell University, the University of California, Berkeley, and Columbia University.

Amidst reports of discriminatory threats on campus, Cornell took a direct, condemnatory approach. In an email sent to all university students and staff, the administration explicitly stated their disappointment in the "bias attitudes or actions" aimed towards the Asian community and emphasized the need for the commitment to "diversity and inclusion" in this time of need [5]. Yet the administration stated no consequences for those who have inflicted such pain, thus demonstrating weak support for their Asian student population.

However, not every college administration reacted in the same manner towards the coronavirus threat. On the Instagram page and website of Berkeley's University Health Services, the university explicitly wrote that a "normal" reaction to the threat of illness was "xenophobia: fears about interacting with those who might be from Asia and guilt about those feelings" [6]. Their message immediately received intense backlash from alums and media outlets, slamming the university for normalizing racist mindsets — a bold move for a college in which 40% of the student body is of Asian descent [7]. Although the university removed this statement from their website and issued an apology, their actions have inflicted lasting damage. Such a statement makes Asian students believe that their administration will not support them and would not take action if they tried to report a racial assault.

Yet, nothing quite encapsulates the double standard of academic administrations as the racist events occurring at Columbia University. In early 2020, two name tags of Chinese students were burned off of their dormitory door in East Campus, a blatantly racist attack. With such an outright act of aggression, one would think that the Columbia board of administration would investigate it — if not for reasons of discrimination, at least for the threat of arson. Yet Ren Huang '22, a Barnard College student, recalls that the university chose not to report this incident or even notify the student population about it until another separate racial incident involving the drawing of swastikas occurred. She also states that no group counseling or reflection session was offered for the Asian community to come together and discuss the event, even though these services are generally offered for other instances of prejudice, including the swastika incident [8].

In all of these instances, students and alums have taken to social media condemning not only the actions of racist students, but also the administrations for not launching proper investigations. So why do such acts of prejudice continue? I, along with other Asian Cornell students such as Ruitong Liu '22, believe that it comes down to misunderstandings and a lack of knowledge about the coronavirus. Ruitong states that one of the largest misconceptions the public makes is the cultural meaning of a mask. She emphasizes that many Asian people wear the now-recognizable blue face masks regularly, a norm for "an effective way of self-protection" for anything from dust bunnies to air pollution to illnesses. However, Americans view it as a mark of disease and thus spread rumors of fear against those who are simply trying to protect themselves [9]. Additionally, Ruitong expressed her frustration when listening to conversations about how the Chinese government's ignorance led to the mass spread of the virus. In actuality, China took extreme precautions once it was aware of the seriousness of the pandemic to attempt to limit its spread. Through the fast creation of "fever hospitals," use of contact tracing, and a massive lockdown on traveling to and from Wuhan, the Chinese government and public health officials were as efficient as possible when attempting to find infected peoples. The peak of the virus in China has now passed, as transmission rates have decreased heavily within recent weeks [10]. Therefore, contrary to the comments that Ruitong heard, China's massive efforts have actually improved the coronavirus situation to the point where the World Health Organization has suggested that other countries follow China's lead.



The scapegoating of coronavirus has gone on long enough and affects millions of real peoples' lives. Chinatowns and Chinese-owned stores across America are losing business, and the meaning of being Asian has been questioned and stigmatized. Yet, this virus took hold early on in Italy – why have we not heard of any racial attacks on those of European descent? The answer is clear for one infuriating reason: Asians have always been racially profiled in America. From the scapegoating during the Third Plague Pandemic to whitewashing in the media to the overarching issue of calling every Asian person "Chinese."

discrimination uses Asians as an easy target, and it is time to end such disgraceful actions once and for all as a culture.

Although Jiraprapasuke was able to share her story, there are thousands of similar instances occurring that go unrecognized. Through better education of infectious disease and healthcare, I hope that increased awareness of the coronavirus may convince people to not scapegoat the Asian population and help them understand the nature of pandemics. In our Cornell, New York, and hometown communities, I ask us all to be mindful of our words and actions and to support, not ostracize, the Asian community as we endure an incredibly difficult time together.

If you feel that you have been a victim of any forms of discrimination, including verbal or physical hate crimes, you can submit a Cornell bias incident report form at https://diversity.cornell.edu/our-commitments/bias-reporting-cornell [11], call the New York State hotline at 1-888-392-3644, or text "HATE" to 81336 for more options [12].

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Strategic Implementation of Artificial Intelligence Against Pandemics By Dhanya Mahesh '21

For data scientists, saving the world does not just include staying at home and binging Netflix, but also joining Microsoft, Alibaba, and Google to create artificial intelligence solutions to the coronavirus pandemic [1]. These solutions utilize millions of biological data points to generate dozens of drug proposals or computer vision programs that can predict the presence of disease based on chest X-rays [2]. It is becoming clear that Artificial Intelligence (AI) is an important tool for ending this pandemic [3].

Although these new solutions are impressive, the process of applying artificial intelligence to medical practice is a much more complicated process than you might think [2]. For example, drugs have to undergo laboratory testing, animal testing, and human testing before being FDA approved and released to the public [4]. In a similar vein, machine-learning programs that diagnose diseases undergo several rounds of testing and must be able to adapt to different types of data [2]. It follows that without access to a large amount of high-quality data from a diverse cohort, these artificial intelligence solutions cannot be evaluated [5].

A diverse and large dataset creates a solid foundation for a successful artificial intelligence platform [6]. Without diversity in data, AI programs make egregious errors such as misdiagnosing heart attacks in women because their symptoms are different than those in men [7] or assigning artificially lower risk scores and impersonal healthcare options for black patients admitted to hospitals [8]. To avoid biases such as these, and to make AI solutions more accessible and effective as quickly as possible, data scientists need to prioritize data collection in all communities, especially among underserved populations such as rural communities. When the data is inclusive of all communities, artificial intelligence solutions can be powerful and flexible enough to take on a pandemic [6].



One of the first steps to improve dataset quality is to introduce modern health technologies to all communities. Research shows that new technologies such as mobile phone cloud computing applications and digital health record platforms can improve data quality [9]. Artificial intelligence solutions developed using these types of technologies in underserved communities have also been shown to be highly effective at improving health outcomes or increasing health care access [10,11,12].

For example, bringing the computerization of medical records to rural communities offers a wealth of data for artificial intelligence analysis. In Kenya, OpenMRS, an electronic medical record platform, has been shown to both improve data quality and HIV treatment rates in rural areas over the traditional paper based system — after the implementation of this system, data completeness improved by 40% while the number of patients found to be eligible for HIV treatment increased by 23% [10]. A review of the implementation of electronic medical records in resource poor areas shows that data quality and medical error rates have generally improved after the adoption of this technology [13]. In this way, adopting electronic medical records universally ensures a high quality and complete, standardized datasets for artificial intelligence solutions.

In addition, mobile cloud computing, using remote servers to process and store data instead of a single device, provides a powerful opportunity to collect and analyze diverse varieties of medical data for artificial intelligence analysis [9]. Analyses run with cloud computing have been shown to bypass mobile phone memory limitations, save energy, and output high-quality results [14]. For example, applications such as Apple's HealthKit collect patient electronic health record data, pharmacy data, and insurance information, allowing Apple to build powerful AI programs that can diagnose diseases and determine the effectiveness of certain treatments [15]. In addition, incorporating cloud computing into hospital systems can improve care coordination by providing a complete picture of the patient's health history. Even in rural areas that lack strong IT infrastructure, cloud computing models can increase data quality. For example, researchers were able to successfully implement an interactive voice response program using cloud computing models for diabetes management in an underdeveloped low income area of Honduras. The program, which collected patient updates and provided individualized health information via voice calls and messages, increased the amount of health information collected for each patient and improved diabetes medication adherence rates [11].

In general, data collection strategies and platforms such as electronic medical record digitization and mobile applications offer high-quality datasets and platforms needed to develop effective artificial intelligence solutions [9]. When the program development process is streamlined in this way, public health emergencies such as epidemics can be addressed sooner.

For example, researchers at the Medical College of Georgia have been using mobile phone technology to assess individual coronavirus risk and alert local medical facilities if needed. The information collected from smartphone users will improve the identification and prediction of areas where the virus spreads. The mobile application improves the accessibility and rapidity of the artificial intelligence analysis, allowing the program to be developed and released in the span of a few weeks [12]. In this way, the application can reduce the strain of the virus on the healthcare system and help providers quickly identify high-risk patients and populations to mitigate the spread [16]. Other successful AI solutions for the coronavirus also make use of diverse datasets and the widespread use of mobile phone technology.

For example, the South Korean government has been highly successful in containing the disease due in part to the collection of coronavirus data and the release of accurate coronavirus hotspot information through mobile phones [17]. Additionally, Taiwan's government has integrated immigration, customs, and the country's National Institute of Health data to create programs that identify high-risk individuals from travel information [18].

The key to these successful artificial intelligence solutions is to utilize a sufficiently large and diverse dataset [5]. To build these types of datasets, healthcare technology must be brought to all communities, especially rural underserved populations. Technology implemented on mobile phones and digital electronic medical record platforms effectively increases data quality and completeness, laying the foundation for powerful artificial intelligence solutions that can handle pandemics [9]. AI constructed in this way can rapidly help identify diseases in different areas, deal with different disease manifestations, and prioritize high-risk patients, rather than overwhelming the healthcare system [16,19]. Rapid implementation of these programs would save countless lives and provide better allocation of healthcare resources [20]. To further respond to the current pandemic and prepare for future epidemics, data scientists should embed high-quality data collection platforms in their artificial intelligence infrastructure.

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Could the Next Pandemic Be Prevented? Exploring How and Why Most Outbreaks Develop By Taelor Matos '23



Disease outbreaks are common throughout history, creating political and economic difficulties that drastically affect people's lives. As we can observe from the rapid spread of COVID-19, attacking a disease retrospectively is not effective enough to stop it in its tracks. Rather, the development of systems to prevent novel outbreaks before they happen is critical. Therefore, examining how diseases manifest themselves in the first place is integral to preventing their spread and protecting vulnerable populations. Given the historical trend of disease emergence and spread, what can be learned from the origins of outbreaks past and present to inform those in the future? As discovered by Taylor, Latham, and Woolhouse in 2001, of the approximately 1,415 species of infectious organisms that cause disease in humans, 175 are "emerging pathogens," of which 75% have evolved from the transmission of pathogenic agents from animals to humans, known as zoonosis. This is important because zoonotic pathogens are twice as likely to cause disease when compared to non-zoonotic pathogens [1]. Yet, the specifics of how exactly this transmission process occurs are still being explored.

In their 2010 article, researchers Pike, Saylors, et. al, described the five stages of a pathogen's progression from its reliance on strictly animal hosts (Stage 1), to strictly human hosts(Stage 5). For example, some well-known diseases such Influenza A, AIDS, and smallpox are said to have progressed through the latter stages, since they do not require reintroduction to their original animal hosts to survive [1]. The factors that lead to a virus's initial jump from animal hosts to human hosts are largely influenced by the frequency and kind of interactions that occur between humans and animals. This includes fresh animal markets, hunting and butchering practices, and domestication of animals [1]. Thus, the frequency with which humans interact with animals increases the probability of zoonotic transmission of a disease. Another critical aspect of zoonotic disease control is understanding which animals humans interact with the most, and what pathogens those animals have. Moreover, a holistic understanding of the different economic and cultural factors that create environments where there is an increased risk for zoonotic transmission agents than individuals living in the United States [2]. These factors must be taken into account when prevention of global disease emergence is the goal.

COVID-19, caused by the virus, SARS-CoV-2, is hypothesized to have emerged from a human's interaction with an animal in a live seafood market in Wuhan, China [3]. It is not yet known which species specifically transmitted the virus but pangolins are suspected, and subsequently, their international trade has been banned [3]. Arguments for stopping the global trade in wildlife could be a preventive measure for the emergence of future diseases, but this holds clear economic consequences. Another potential solution may be developing education programs for populations directly involved with animals that are geared towards limiting contact with bodily fluids, covering opening wounds, etc. [4].

From a larger, preventative perspective, analyzing global travel seems to be a relevant consideration; incidence mapping and contact tracing can be helpful tools when attempting to stop the progression of a disease early on [4]. Even still, the interconnectedness of the modern world makes tracking all interactions increasingly difficult.

Human behavior and globalization demonstrate society's increased vulnerability to current and future disease outbreaks. The specifics of future outbreaks may be difficult to pinpoint, but the reality is that zoonotic transmission will likely be the way it begins. Understanding the complexities of disease emergence and spread can inform epidemiologists, healthcare workers, politicians, and the everyday global citizen how to best prevent and predict the next outbreak.

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The Significance of Telemedicine During the COVID-19 Pandemic By Melvine Gomilla '22



Over the past few years, technology has played an increasing role in the healthcare industry through the incorporation of telemedicine into medical practices. Telemedicine, according to the Center for Medicare & Medicaid Services, improves a patient's health by allowing for "two-way, real time interactive communication between [a] patient and [a] physician or practitioner at [a] distant site" [1]. As a result, telemedicine has significantly affected the quality of care in the United States.

For one, telemedicine is more cost effective than in-person physician visits. A research article published by representatives of the South China University of Technology found that telemedicine can help reduce the total cost of the healthcare system as well as a patient's waiting time [2]. Additionally, telemedicine allows patients living in rural areas and those facing accessibility issues to receive quality health care. Furthermore, Deloitte Consulting LLP analysts and consultants have found that telemedicine can enable immediate assessment and triage, increase access to high-demand specialty care, and advance chronic disease management and home care as well [3]. The benefits of telemedicine have already begun to prove important during the COVID-19 pandemic.With more and more individuals consulting their primary care physicians about their symptoms, telemedicine services are more important than ever. The nation's top infectious disease expert, Dr. Anthony Fauci, M.D. '66, has recommended "social distancing," which are acts that attempt to increase the physical space between people such as standing 6 feet apart. Hence, social/physical distancing is leading people to avoid contact with anyone besides their immediate family and other members of their household. A majority of states have required that residents stay at home [4].

As a result, telemedicine allows individuals who are self-isolating to contact a doctor, discuss their symptoms, and receive a response on whether or not they should get further testing. The Cleveland Clinic, located in Cleveland, Ohio, has seen success through their telemedicine platform called "Express Care Online," which many patients worried about possible coronavirus symptoms have visited. Emergency departments have seen a reduction in the amount of people visiting with coronavirus-related concerns on account of telemedicine implementation. Therefore, because of telemedicine, Emergency Department resources can be utilized for more critical coronavirus cases. With many states currently looking to re-open, telemedicine will continue to play an important role as the most vulnerable populations seek care from physicians without face-to-face interaction.

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Remdesivir Emerges as Promising New Drug Candidate to Treat the Novel Coronavirus By Sarah Lim '23



In December 2019, an unidentified coronavirus caused a novel pneumonia to emerge in Wuhan, China. Observed to induce severe respiratory distress in a small percentage of cases, the novel coronavirus, or SARS-CoV-2, quickly captured global attention as it spread to over one hundred countries across the world. On March 11, the World Health Organization (WHO) finally declared a pandemic, acknowledging that the novel coronavirus has and will continue to affect regions around the globe.

As the number of confirmed COVID-19 cases grows by the day, so too does the demand for a method to treat or prevent the virus. As a result, international organizations, governmental agencies, and pharmaceutical companies have been coordinating efforts to develop potential therapeutic methods to combat the disease. Though there are several drugs currently under investigation, an American biopharmaceutical company, Gilead Sciences Inc., has found potential in a medication known as remdesivir.

Remdesivir (RDV; GS-5734) is an antiviral drug that works against a wide array of RNA viruses including SARS-CoV (SARS-associated coronavirus) and MERS-CoV (MERS coronavirus). Since SARS-CoV-2 belongs to the same family of coronaviruses as those currently treated with remdesivir, researchers have primarily focused on investigating whether antiviral drugs already in existence will prove efficacious in treating COVID-19 infections [1].

At a molecular level, RDV is an investigational adenosine nucleotide analog that has displayed antiviral activity against several RNA viruses in cell culture, non-human primates, and mice. Although RDV's role in fighting human coronaviruses is not yet understood, the investigation of RDV in treating the Ebola virus (EBOV) has contributed to a growing field of knowledge surrounding its effects on human viral infections.

By expressing and purifying the EBOV RNA-dependent polymerase (RdRp) complex, researchers have found that the triphosphate form of RDV (RDV-TP) can compete for incorporation with its natural counterpart, adenosine triphosphate (ATP), to inhibit EBOV RNA synthesis through delayed chain termination [2]. In simple terms, RDV has been shown to prevent the Ebola virus from replicating.

In addition to EBOV, scientists have investigated RDV's effects on other RNA viruses, including MERS-CoV. To test the antiviral capabilities of RDV against MERS-CoV, a team of researchers from the United States co-expressed the MERS-CoV nonstructural RdRp proteins in insect cells and allowed the RDV's mechanism of inhibition to take place. RDV demonstrated a strikingly similar mechanism of action for arresting viral RNA synthesis as that observed in the investigation of RDV treatment for the Ebola virus [3]. According to a new report from the National Institute of Allergy and Infectious Diseases (NIAID), the experimental RDV "prevented disease when administered before infection and improved the condition of macaques" that were infected with MERS-CoV. The macaques showed "no signs of respiratory disease, significantly lower levels of virus replication in the lungs compared to control animals, and no lung damage" [4].

Working closely with global health institutions and authorities to respond to the COVID-19 outbreak, Gilead Sciences has initiated clinical investigation of RDV for the treatment of novel coronavirus cases in adults. Following the U.S. FDA's approval of Gilead's investigational new drug filing, the company began work on two phase III clinical trials to study the effects of a 5-day and 10-day regimen of RDV in patients showing severe symptoms. Currently underway at multiple sites in China, as well as in other countries with high numbers of diagnosed patients, the trials will provide the investigational drug to study subjects free of charge [5]. In addition to the aforementioned phase III trials, Gilead has also partnered with the NIAID to conduct an additional RDV trial for patients needing supplemental oxygen due to severe respiratory symptoms. Scientists will assign eligible participants to either the experimental group or the placebo group; those in the experimental group will receive a determined dose of RDV for up to ten days, while those in the placebo group will receive the same dose of an inactive solution. The outcomes observed in the experimental and placebo groups will then be compared to examine the efficacy of RDV in treating COVID-19 [6].

Although a successful therapeutic agent for the treatment of COVID-19 has yet to be discovered, preliminary evidence suggests that remdesivir may serve as a promising option. While the days seem long as social distancing ensues, scientific breakthroughs are surely occurring at a rapid pace and will contribute significantly to the future course of the novel coronavirus.

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The Use of Facemasks Amidst the COVID-19 Pandemic: Helpful or Harmful? By Mariam Trichas '22



During the early days of the coronavirus pandemic, officials discouraged the general public from using face masks, stating that masks should be saved for healthcare workers on the frontlines. Nevertheless, shortages of personal protective equipment (PPE) across the country have prompted many doctors and nurses to turn to alternative forms of face protection, such as bandanas or scarves. While handmade or makeshift masks are likely better than no form of protection at all, the use of improper PPE places healthcare workers at higher risk of contracting the virus and healthcare systems at increased risk of becoming short-staffed. If doctors and nurses are sick, who will be left to treat the general public?

In response to the PPE shortage, "the Trump administration has activated the Defense Production Act, a once-obscure law that could let the [federal government] dictate what equipment is produced and where it goes" [1]. Although the federal government has redirected some equipment from the national stockpile to states that are in need, these efforts have proven ineffective for relieving the national shortage. As a result, there have been countless reports of healthcare workers still having to use homemade alternatives' or even reusing PPE [2].

Compounding the shortage, China, which produces half of the world's face masks, has been hoarding masks that would have otherwise been exported to other countries. As the outbreak spreads throughout the globe, other countries have followed suit, making it even harder for the United States to obtain necessary PPE. Some countries, such as Germany, have "even ban[ned] most PPE exports" [3].



Yet, even with PPE shortages in mind, many individuals still share a common concern: should we all be wearing masks? Increasing evidence suggests that the use of masks could prevent the spread of coronavirus by covering places where "germ-containing droplets" are most likely to enter a person's body and infect them with the virus, such as the mouth and nose [4]. Additionally, masks could prevent viral transmission , as even breathing can disseminate air droplets onto surfaces [4]. Preventing the spread of may prove particularly beneficial as growing evidence suggests that asymptomatic transmission –—when an individual experiencing no symptoms transmits the virus to others— plays a substantial role in community spread of COVID-19 [4].

Recently, CDC officials have offered new guidance urging people to wear DIY face masks in public. However, the CDC remains hesitant to advise mask wearing as they know that "ordinary people seeking facial protection will siphon needed masks from the limited stockpile" [4]. Medical professionals have also voiced concern that encouraging mask-wearing will minimize social distancing efforts, as it will give people a false sense of security [4].

To further prevent the spread of the novel coronavirus, the CDC "continues to [encourage] everyone to engage in social distancing and to not stand within six feet of another person, especially someone suspected of being sick" [4]. Though some may disagree on the proper role of masks amidst this pandemic, most would agree that the simple things individuals can do to "flatten the curve" like washing one's hands and disinfecting surfaces will ultimately pay off.

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The Scary Reality Behind "Renting a Womb" By Jisoo Ha '23



Pregnancy can be a beautiful process that leads to new life. However, not all pregnancies are so delightful – one of the ethically complicated situations under the umbrella of pregnancy is surrogacy. Surrogacy, now a multi-billion dollar industry in the United States [1], is a transaction in which a woman can carry a baby for others who cannot carry babies themselves. Clients for this service include same-sex couples, women without wombs, and women at risk for pregnancy-related

complications, to name a few. A famous example of this is Kim Kardashian, who had two of her four children via surrogacy after complications during her first two pregnancies. At the surface, surrogacy is not ethically worrisome. However, when digging deeper, exploitation is evident in the practice as surrogate mothers rent the use of their bodies in a commercial transaction without being informed of the hazards/dangers.

There is a lack of national regulation around surrogacy in the US, despite the practice rising in popularity. A 2016 CDC report says that 18,400 surrogacy babies were born between 1999 to 2016. However, the actual number is likely much higher because of surrogacy's rise in popularity and lack of regulation [6]. Because surrogate mothers contract with agencies, there is a potential for surrogacy agencies to make a massive profit from this transaction by dismissing psychological and physical dangers of the process in order to draw women in.

On average, surrogate mothers in the US are paid \$20,000 to \$25,000 per pregnancy. This comes to around \$3 for every hour the surrogate mother is pregnant or in labor [1], far less than the national minimum wage of \$7.25 [5]. This commercialization can result in the exploitation of low-income women, as those in desperate need of money may become surrogates despite not being paid well. A targeted group of low income women in the US are military wives. These women make around \$16,000 per year, which makes surrogacy an attractive and viable option to double their income. Furthermore they are considered "easy recruits" to big private enterprises because they have a service mentality that stems from sacrifice and loyalty to the nation and other people and they are assumed to be celibate while their husbands are stationed overseas. In addition to these factors, military wives have few legal protections, which increases the likelihood that they are in exploitative situations. As a result, many surrogacy clinics are located where there are large military bases such as Texas, California, and Florida [6].

Despite the financial incentives associated with surrogacy, the risks are not to be overlooked. Furthermore, due to the cost of surrogacy and the desire for a successful implantation, multiple embryos are implanted, increasing the risk of Cesarean section, perinatal complication such as gestational diabetes, fetal growth restriction, and pre-eclampsia, premature birth, and sometimes death [2]. Jennifer Lahl, director of the documentary Breeders: A Subclass of Women, explained that one surrogate almost died due to high-risk pregnancy complications and was told that it was her fault. She was accused of her health problems by the intended parents saying she did it on purpose to make more money [4]. Lahl also said she met several surrogates who suffered from post-traumatic stress disorder after their experiences [4]. Surrogate mothers are rarely informed of these risks as companies want to make profit, degrading pregnancy to a service and a baby as a commodity.

Additionally, surrogate mothers rarely have a voice regarding what environment they think will be for the child's best interest. Melissa Cook's surrogacy journey became an eve opening story in 2015. She was carrying triplets for a father who wanted to abort at least one because he couldn't afford to raise them all and was in a living situation unsuitable to raise children [7]. After her children were born, the custody was given to the father, who left the children alone unattended for long periods of time. Seeing this, Cook fought for custody, but was denied at lower courts because the emphasis was put on enforcing contracts. However, she stated, "there are rulings that have to be made [when dealing with a child's life!" [7]. Along with Cook, two other surrogate mothers have filed lawsuits and called on the Supreme Court to provide more regulation for the rights of surrogate mothers and children in the industry. They state that surrogacy contracts are exploitative to the mothers by "creating a class of women as breeders" and are "commodifying children" [7]. Another surrogate mother, Toni Bare, was emotionally abused throughout her pregnancy by the "intended" parents who subjected her to profanity and ugly racial comments. She quoted, "I had a moral obligation to my daughter not to place her in a home that teaches hatred. I could not allow that to happen" [7]. This is one of the scarv realities behind surrogacy - a lost voice of being a mother because of a signed paper contract.

Not only are surrogates denied the right to express their beliefs and endure the physical implications of pregnancy, but they also shoulder the emotional burden of carrying a life for nine months. 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...not only were there reproductive health risks, but it was impossible for me to know exactly what I would be going through during pregnancy and what I was giving up post-birth" [3]. 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 carried, even though they knew they would be giving up these children at the end of their pregnancies [4]. Furthermore, if we know that emotional attachments are made between a child and any mother, it is only fair to allow surrogates to be treated with respect and justice by giving them a voice for the future life of her child.



Surrogate children are also at risk emotionally. A report published in the Journal of Child Psychology and Psychiatry found that children who were raised by mothers other than those who gave birth to them faced increased psychological adjustment issues such as depression around seven years old [4]. Moreover, children born through surrogacy are more likely to be of low birth weights or be stillborn. A study in 2014 from the Journal of Perinatology found a 4–5 fold increase in stillbirths from pregnancies through assisted reproductive technologies [2]. As these children grow up to become young adults, they suffer serious genealogical bewilderment, a term referring to potential identity problems experienced by a child who was fostered, adopted, or conceived from surrogacy. Beyond this, children of surrogate mothers have no access to information about their potential biological siblings either [2]. This uncertainty behind their geneology induces stress that is not experienced by children raised by their natural parents.

Adding to the physical and emotional anguish of surrogate mothers, they are also faced with financial struggles. Agencies leave surrogates with "hefty financial burden" by not defending them when a conflict of unpaid medical payments arise [4]. A five-time surrogate mother from South Dakota, Kelly, shared that the intended parents took the child and left her with thousands of dollars in unpaid medical bills, leaving her with much financial stress and heartache [4].

The serious ramifications of surrogacy deserve to be voiced in order to decrease the potential exploitation of women who might consent to the surrogacy transaction without knowing all the potential risks and hidden injustices. Surrogacy is oftentimes brushed over as an altruistic act for a couple who cannot carry a child on their own. The scary reality is that surrogacy degrades a pregnancy to a service and hides the emotional and physical health risks confronted by 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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The USMLE Step 1 Controversy By Emma Miller '20



The United States Medical Licensing Examinations (USMLE) Step 1 and Step 2 are standardized tests taken during medical school to assess the knowledge of future physicians and their readiness to become residents [1]. However, the USMLE exams have raised concerns due to their inability to test patient care skills, their staggering prep costs, and the stress they cause medical students. Many years of criticism and evaluation have prompted the transition of the traditional Step 1 exam from a graded scheme to a pass/fail one [1].

The purpose of Step 1 is to assess medical knowledge taught during the initial years of medical school. Residency program directors use results from Step 1 in order to gauge the performance of a medical student [1,2]. However, some argue that because Step 1 forces students to focus solely on tested content, it diminishes the importance of material that does not appear on the exam. In order to encourage the development of well-rounded physicians, education must focus not only on preparation for standardized exams, but also on aspects of medicine like clinical medical ethics, patient care, and cultural awareness. Additionally, studies suggest that there is "little correlation between Step 1 scores and meaningful outcomes in regard to patient care" [3]. Clinical skills such as bedside manner are not tested on Step 1, and yet these attributes are paramount when entering certain residency programs. Therefore, the current system of placing strong emphasis on test scores prevents directors from considering clinical abilities [4]. Establishing Step 1 as a measurement for students' potential skills as a physician is misleading, as the test scores are not a true indicator of clinical abilities.

Another controversy surrounding Step 1 is the exorbitant cost of preparation materials, which inevitably provides an advantage to students from wealthier backgrounds [4]. This issue is also apparent for other standardized exams that require expensive resources, such as the Medical College Admission Test (MCAT). While the estimated cost of Step 1 materials, \$1500, is affordable for some, there are many disadvantaged students who cannot afford the resources necessary to achieve a high score [4]. It is unjust for the sheer cost of exam preparation and registration to place constraints on who will be successful. With this financial disparity in mind, it is difficult to assert that Step 1 provides an equal evaluation of knowledge among medical students, as some students can afford better preparation than others [2,4].

But perhaps the most distressing and prevalent problem raised by medical students preparing for Step 1 is the deterioration of students' mental health. The academic intensity of medical school is common knowledge, and burdening medical school students with Step 1 in addition to the rigorous curriculum further increases the students' extreme levels of stress and anxiety [5,6]. Since residency directors use Step 1 scores to evaluate the candidate's potential to perform well in a professional environment, medical students are forced to



earn how to take this specific standardized test while simultaneously maintaining their academic performance in medical school; thus, the exam further contributes to high stress and anxiety. According to studies conducted among medical students, "self-reported stress and quality of life ... will vary in their relationships to USMLE Step 1 scores," which provides insight regarding the impact Step 1 has on students' mental health levels [6]. While students who obtain higher scores may not be as stressed after the examination, generally all students experience severe anxiety and pressure prior to exam day [5,6].

With these problems in mind, the recent decision to evaluate students' Step 1 results in a pass/fail scheme appears to be the most beneficial decision to improve the mental and financial health of students, as well as the bedside manner of those selected to be residents [2]. These grading changes will have inevitable consequences, as the pass/fail grading places a burden on residency directors when selecting prospective residents. Thus, numerous evaluations regarding this decision recommend that directors should gradually phase out the use of Step 1, allowing program directors to assess other data to inform residency decisions. Guiding residency directors to concentrate on virtues such as social and critical thinking skills rather than medical students' ability to take an examination will allow future doctors to thrive and provide patients with the highest quality of care [2,3].

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Democrats and Public Healthcare By Komala Anupindi '23

In America's current political climate, it is hard to fully express the dramatic implications that healthcare changes can have on the country's future. For voters, it can be difficult to separate the media speculation from the multitude of candidate biases present. For the purpose of this article, the focus will be on the potential healthcare policies of assumed Democratic Presidential Nominee Joe Biden and Bernie Sanders.

The healthcare policies presented by Joe Biden and Bernie Sanders are similar since they advocate for an expansion of public insurance but the way in which they present these policies differs. Both candidates agree that all Americans should be required to have health insurance, eliminating the adverse selection that drives up the cost of premiums [3]. However, the primary differences between the two candidates are their views on public insurance and how to expand insurance coverage to all Americans.

Sanders's famed Medicare for All advocates for the removal of all private insurance plans with the exception of supplemental care outside of the basic insurance. The basic insurance plans cover basic medical expenses but Sanders's plan also plans to include dental, hearing, and vision care [1]. This single-payer plan is drastic, as it would also cover health-care related costs considered outside the realm of typical insurance plans, such as mental health coverage, vision, dental, and prescriptions [2]. The idea is simple, as Sanders declares, "no networks, no premiums, no deductibles, no copays, no surprise bills" [1]. This motto allows Sanders to give his supporters the idea of equity that they have been advocating for- everyone would face zero charges.

On his website, Sanders outlines three objectives he hopes to accomplish, with a specific focus on lowering prescription prices. "1. Allow Medicare to negotiate with the big drug companies to lower prescription drug prices with the Medicare Drug Price Negotiation Act.2. Allow patients, pharmacists, and wholesalers to buy low-cost prescription drugs from Canada and other industrialized countries with the Affordable and Safe Prescription Drug Importation Act. 3. Cut prescription drug prices in half, with the Prescription Drug Price Relief Act, by pegging prices to the median drug price in five major countries: Canada, the United Kingdom, France, Germany, and Japan."

However, future plans for Sanders have a few hinderances, as well, that are not as heavily mentioned on his website. It may seem as though Sanders is ignoring the international implications of these lower prescription drug prices, the main focus of his new plan. The competitive private health insurance market allows for funding to go to the development of new drugs. Without the competition of private health insurance companies in America, the development of new pharmaceutical drugs might decrease dramatically, though the specific percentage is still an unsurity [6]. This decrease has the potential to result in a disastrous healthcare industry where pharmaceutical drugs are not a focus for development and individuals will not get the development of new drugs that will help their conditions in the future.

In contrast, Biden's healthcare plan is more conservative in its expansion but reverts to the Obama-era healthcare policies which the Affordable Care Act attempted to pass [5]. The public option, as Biden's website expresses, "the Biden Plan will give you the choice to purchase a public health insurance option like Medicare. As in Medicare, the Biden public option will reduce costs for patients by negotiating lower prices from hospitals and other health care providers" [4]. This option is marketed towards individuals who do not qualify for public health insurance plans like Medicaid and Medicare or those that don't receive health insurance through their work. This public option allows those in the private health insurance market who cannot afford the health insurance plans access to an option that is more affordable and manageable for the average American [5]. This alternative targets the Americans affected by the controversial coverage gap of the Affordable Care Act and is specifically directed towards the states that decided to not expand Medicaid. In the present political situation, nearly two million adults fall under the coverage gap and fourteen states have refused to expand Medicaid coverage to individuals that fall below the 138% poverty line [7]. Under the Biden Plan, all Americans affected by the coverage gap would automatically receive the public option, giving them an affordable plan for health insurance [4].

Another essential component of Biden's plan for healthcare is the premium tax credit, which Biden guarantees middle-class families will receive. This premium tax credit is capped at 8.5% of an individual's income, therefore guaranteeing equitable premiums and more affordable healthcare [4]. Biden's offering is also flexible because individuals can shift from their private plan to Biden's plan, even if the plan they are switching from is the plan offered by their employer. According to Biden, his insurance plan still grants Americans a choice between private and public health insurance while providing all Americans with an affordable alternative making the effort to cover all Americans. Both plans have also pledged to cover all undocumented immigrants in their plans, which is definitely a step towards universal access to health care [2]. In contrast to the current healthcare plan that Americans have, both plans are better options to expand coverage to more individuals but whether the United States has the funds to do that in the healthcare sector is still unknown.



As mentioned above, both plans are in favor of changing the current health care system, as is evidenced by the push for coverage expansion and substantial cost reduction [2]. Sanders' plan is significantly more comprehensive in this expansion and guarantees universal health coverage at the same price: something Biden has yet to do. However, the Biden's plan represents an intersection of public and private options thereby giving citizens a new option for more affordable and direct healthcare coverage [2]. In the political atmosphere, all Democrats in Congress have expressed interest in a public option for private health insurance, which aligns with Biden's proposed plan [3]. However, it still remains to be seen whether these plans will find a way to become a reality, all of which is dependent on the election in November 2020.



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Celebrity or Scientist? Misinformation about Vaccinations By Violet Filer '22



Jessica Biel: Mother, Wife, Actress, Model, Producer, Singer and...Scientist? In a recent Instagram post to her 8.5 million followers, Biel detailed her meeting with prominent anti-vaccine activist Robert F. Kennedy Jr. at the California State Assembly to lobby against SB-276, a California bill that aims to limit medical exemptions for vaccines unless parents have the approval of a state public health officer. Armed with the unfounded belief that vaccination was linked to a child's illnesses, Biel decided to ignore medical advice and not adhere to a regular vaccination schedule for her child. To accomplish this as a lawabiding citizen, Biel engaged in a practice known as "doctor shopping," which is the deliberate attempt to find a doctor who will delay vaccinations for children. She then heavily publicized her beliefs to millions of people, thereby shaping their beliefs and perceptions around vaccination Celebrities like Biel, who circulate misinformation about science cause scientific doubt, ultimately inflict harm in the regulation of population health.

In 1998, British researchers published an article arguing that the measles-mumps-rubella (MMR) vaccine causes autism. Even though the publication was labeled as misinformation shortly thereafter, , there has since been an outcry to ban all vaccines among people who are misinformed about science. While the etiology of autism is unknown, there are genetic and environmental factors that affect the development of various forms of this disorder. For example, one of the most common forms of autism has excessive repetitions of the nucleotide bases "CGG" which results in a lack of proteins required for the complete development of neuronal connections in the brain. The severity and symptoms of autism depend on risk factors such as advanced parental age, birth control complications and pregnancies less than a year apart. None of these factors appears to be to vaccinations, but the misconception arose due to the exponential increase in the number of diagnoses of autism that occurred around the time of the British publication. In reality, newly developed technology was implemented that allowed physicians to properly diagnose autism with an official medical code, as opposed to the previous use of psychiatric testing. Public hysteria and medical uncertainty incited fear and doubt among the masses that caused suspicion of not only the MMR vaccine, but also of vaccinations in general.

Celebrities without any scientific background then began using their social media platforms to lobby against vaccinations and the supposed lack of safety surrounding vaccinations. Reality TV star Kristin Cavallari appeared on Fox News, proudly boasting that she had not vaccinated her son. Camden, proclaiming "Listen, to each their own. I understand both sides of it. I've read too many books about autism and there's some scary statistics out there. It's our personal choice." American actress Alicia Silverstone published the book The Kind Mama: A Simple Guide to Supercharged Fertility, a Radiant Pregnancy, a Sweeter Birth, and a Healthier, More Beautiful Beginning, criticized vaccinations saying "there has not been a conclusive study of the negative effects of such a rigorous one-size-fits-all, shoot-'em-up schedule." Similarly, comedian, writer, and artist Jim Carrey has also publicly come out against mandatory vaccination, writing in the Huffington Post in 2009: "In this growing crisis, we cannot afford to blindly trumpet the agenda of the CDC, the American Academy of Pediatrics (AAP) or vaccine makers. Now more than ever, we must resist the urge to close this book before it's been written." Finally, a highly outspoken anti-vaxxer in Hollywood, Jenny McCarthy, has vocalized her beliefs about vaccinations on news stations, Instagram, and Facebook. When her two-and-a-half-year-old son was diagnosed with autism, she attributed his condition to the MMR vaccine, telling PBS Frontline, "We're pro-safe-vaccine schedule." Celebrities without any background in science are able to use their stardom and social media platforms to circulate these conspiracy theories about vaccinations which have extremely harmful effects on both individual and population health.



Unvaccinated children are not only at an increased risk for diseases such as measles, mumps, and whooping cough, but also pose a threat to other children who have been vaccinated. For example, if a child is cut by metal but they have not received a tetanus shot, the bacteria Clostridium tetani, will cause trismus, continuous spasms, and stiffness in jaw muscles which can be fatal. In addition to personal health, vaccinations also have a herd immunity effect that protects an entire population from infectious agents. People with compromised immune systems, such as those with cancer or HIV, are unable to get vaccinated and rely on the vaccinated general public to reduce their risk of exposure. If even one individual has not received a vaccination, the virus can mutate and spread to an at-risk individual who does not have a strong enough immune system to fight a disease. Since 1998, over 21 legitimate scientific tests were published explaining that there is no connection between vaccines and autism. However, the spread of misinformation by celebrities has since led to the reappearance of diseases such as measles that were once thought to have been eliminated.



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Gifting Children a Day of Illusion: Wish-Granting Organizations By Suri Gime '21



A number of wish-granting organizations accumulate numerous donations to support their mission: present young patients with severe illnesses a day without pain. The largest wish granting organization in the world, Make-A-Wish, grants over 40 wishes to children with critical illness per day. While their mission statement is benevolent, there are criticisms with respect to how they operate.

Ranked the 97th largest nonprofit organization in the United States, Make-A-Wish foundation granted 15,615 wishes in 2018 [1]. I made a simple calculation using the foundation's data from "Program Service Expense" and number of wishes granted in the same year, a wish cost over 5,600 dollars on average [1]. Multiple studies indicate "severity of the negative financial effects on families" with sick children and enlarged financial burden of parents that results in their absence [5,6]. In a situation like this, even if the patient wishes to meet a popular sports player, would that be what they really need? A lot of children "wish" to meet their favorite princess or a superhero. These young patients deserve all the positivity and happiness, but we cannot neglect essential needs like special education and medical expenses that can burden the patient's family. With that average cost of 5,600 dollars per wish, aiding their medical bill and allowing more time with the parents might prove more beneficial for the patient.

Make-A-Wish foundation is also notorious for its high standard to qualify a wish. As the program is mainly run by non-medical professionals, children with eligible conditions are often denied due to the lack of clear guidelines. Medical complications and the original disease complicates each child's case and there are insufficient guidelines to determine the eligibility of the patient's condition. This often leads to disqualifying a potentially eligible child. Rebutting these decisions is also difficult and uncommon. While Make-A-Wish foundation is a non-profit and donationdependent organization, they unfairly hold the sole power to determine if a child is eligible for a wish or not. As a result, the foundation should establish more detailed guidelines regarding wish eligibility. I encountered Make-A-Wish foundation when a popular sports player delivered pizza for a child at the hospital I interned at. During the event, there were people from his team, and sponsors making sure the player was wearing uniforms with their logos visible for the cameras and numerous other people recording the scene. There were no medical professionals among the Make-A-Wish staff and they neglectfully set up food in the children's playroom, which was a nofood, no-water zone. Additionally, medical professionals were not allowed in the playform to create a stress-free environment. The massive crowds in the small room and the stress resulted in worsening the patient's condition for an upcoming surgery.

Only a select few patients from the same floor of the hospital I interned at were invited to join. The wish-making patient's mother wanted to get her child out of the room while the father was taking pictures inside. There seemed to be a clear disagreement between the parents that the organization neglectfully overlooked. This incident made me wonder whether these wish fulfilling events were truly meant to revive a young patient's life at a hospital. Corporate donation and sponsorships represent over 21% of Make-A-Wish foundation's entire source of funds [2]. Behind the wish-granting, participants like celebrities and sports players are seemingly using these events to promote their interests and for publicity. I was concerned but curious at the same time wondering if these young patients were being used as an easy marketing tool. After the surprise visit, the floor was divided between the patients who were invited to the event and those who were not. Some guardians complained that it was unfair of the foundation to invite only a few people to the event. Uninvited children were naturally upset that they could not join. I could not agree with Make-A-Wish foundation's mission if giving one child an unforgettable memory meant upsetting other patients.

More feasible alternatives to these wish-granting organizations are already on the riseEvery Thursday at the hospital, a group of volunteers dressed as Star Wars cast members visited the hospital. The volunteers easily bonded with patients and gave the patients something to look forward to during their time at the hospital. Patients are often scared of the sound of a door knock because it typically means that someone is coming in to deliver news about their surgery, to give them a shot, or to take a blood sample, none of which a child enjoys. On Thursdays, however, children gladly welcome everyone into their rooms and bravely roll up their sleeves for a syringe. This type of community-level volunteering is transforming lives, one at a time without cameras or celebrities.



We do not need to search far to give a little positivity and hope to these children. The Make A Wish foundation has since grown into a massive organization with over 60 chapters in the U.S.A and international branch operating in 45 different countries with their mission;"transform(ing) lives, one at a time". At the end of the day, patients return to their hospital beds. The Make-A-Wish foundation clearly states that a patient must have a "malignant condition that is placing the child's life in jeopardy" to qualify for a wish [3]. Make-A-Wish is aware that a day like this is unlikely to happen again in these children's lives. Rather than gifting a one time magical experience, supporting those smaller volunteering groups might be a better way to help these young patients cope with their reality and give them the power to fight their sickness. People of the U.S. show tremendous amounts of support through immense sums of donation. It's time to change how Make-A-Wish foundation operates and turn to better alternatives.



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Improving Diversity in Medicine By Relicious Eboh MPH '21



How difficult is it to find a doctor who resembles you? According to the Association of American Medical Colleges (AAMC) data on all active physicians in 2018, if you are white, your likelihood of interacting with a white physician is 56%. If you are black, your chances of interacting with a black physician drop to 5% [1]. The Chief Diversity Officer at the AAMC Division of Diversity and Inclusion, Dr. David Acosta, states "Despite more than a decade of work to actively recruit and retain a more diverse physician workforce, progress remains inequitable.[2]" Further action is needed to ensure minority groups are represented in medical education and the physician workforce.

Increasing diversity in medicine has been shown to improve patient health outcomes. In a 2017 observational study of Medicare files, patients treated by international medical graduates had a lower mortality rate than patients who received care from United States medical graduates [3]. It has also been shown that race concordance can improve a patient's experience with physicians and yields better health outcomes [4]. Sabina Springer, a first-year medical student at the University of Pittsburgh School of Medicine, shares how her experiences as a medical student have demonstrated to her the importance of diversity in medicine: ,

"We have diversity in medicine to accurately reflect the immense diversity of the population of patients that we serve. We know, based on data, that patients feel more comfortable, seen, and heard with doctors who look like them and/or who share their life experiences. Doctors who look like their patients are more inclined to advocate for those patients."

With available data indicative of the increased need for underrepresented minorities in medicine, the Division of Diversity and Inclusion at AAMC has created a new road map for academic medical institutions to follow that addresses diversity, inclusion, and equity.
Foundational Principles of Inclusion Excellence is a roadmap that will aid medical schools in "achieving inclusion excellence" [2]. This framework takes on an equity-minded and inclusive approach. AAMC believes that equity-minded learning is "achieved when every person in the academic medical community –medical student, residents, fellows, faculty, and staff – has the opportunity to attain their full potential and no one is disadvantaged because of their social position or group identity [2]." There are five principles of equity mindedness in medical education that look to address the inequities in medical education and ways stakeholders can be involved in aiding in the mitigation of inequities [2]. This framework has the potential to improve the diversity and inclusion efforts of medical education. The equity portion of this roadmap is greatly needed to improve the number of underrepresented minorities seeking medical education. Diversity and inclusion efforts cannot be successful if equity is ignored. Students should reflect the population they are seeking to serve, and faculty should reflect the population they are teaching.

As a hopeful medical student, Springer believes that there will be a positive shift in the way diversity and inclusion are viewed in medical education, "Our voices and experiences matter and directly impact the patients we serve." It is time that medical education seeks to incorporate equitable practices to improve diversity and inclusion at their institutions. This will help encourage future generations to seek a career in medicine and improve patient health outcomes.

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The Failure of Geriatric Care in the United States By Sophia Qu '21



On January 1st, 2011, an unprecedented demographic transition occurred as the first group of baby boomers began turning 65. Over the past century in the United States, the proportion of persons aged 65 years or older increased more than threefold, from 4.1% to 12.9% [1]. With this increase, the United States is seeing greater demands for healthcare, in-home caregiving and assisted living facilities, thereby placing pressure on policymakers. Despite this pressure, insufficient attention has been focused on new approaches designed to improve community-based services, quality of life, and mobility across the life course. [2] Individual communities are tasked with supporting both the physical and mental health needs of older adults. Findings from a 2012 Institute of Medicine report highlight the growing crisis of dementia, substance abuse and mental illness, such as depression, among America's older adult population [3]. The conditions are often stigmatized, resulting in an absence of institutional support for services meant to address them.

First, I want to target the failures of nursing homes in the United States, which have been plagued with bankruptcies and understaffing over the last few years. About 1.3 million Americans are nursing home residents, cared for in 15,600 facilities that offer 24/7 medical care from professional nurses and other medical personnel [4]. However, increasing specialization of physicians in the U.S has resulted in fewer general practitioners—the physicians most likely to care for nursing home patients. The absence of the physician from the nursing home setting leads to poor patient care, placing a heavy burden on the nurses who are asked to perform many diagnostic and therapeutic activities for which they have little training. But there are few registered nurses (65,235) available for the Nation's 23,000 nursing homes [5].

Another unresolved dilemma in geriatric care in the United States is the state of mental health of older Americans. It is estimated that 20% of people age 55 years or older experience some type of mental health concern. The most common conditions include anxiety, severe cognitive impairment, and mood disorders (such as depression or bipolar disorder) [8]. Mental health issues are often implicated in suicide cases and older men have the highest suicide rate of any age group. Men aged 85 years or older have a suicide rate of 45.23 per 100,000, compared to an overall rate of 11.01 per 100,000 for all ages [9]. Additionally, mental health is closely intertwined with physical health:older adults with physical health conditions such as heart disease have higher rates of depression than those who are healthy. Untreated depression in conjunction with heart disease can increase the progression of chronic illness. Older adults are also vulnerable to elder abuse, which leads to physical and psychological harm. It is imperative that the public health system identifies risk factors, increases awareness about mental disorders and effectiveness of treatment, removes the stigma associated with mental disorders and treatments, eliminates health disparities, and improves access to mental health services [10].

Addressing the needs of a large and diverse older adult population will require new and innovative solutions. We need to increase spending on programs for older adults, starting with the prevention of chronic health issues. In addition to addressing the needs of the current older adult population, health policymakers and social workers should ask, "How do we develop effective strategies to support the health of aging Americans, thereby lessening the burden of care on families, friends, social workers and caregivers?"

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Healthcare in the Time of Pandemic: The Elephant In the Room Becomes the Donkey Bearing Society on Its Back By Amrit Hingorani '20



In 50 years, what will come to mind when we think of the year 2020? A lot has happened, from wildfires to an election, but COVID-19 stands out as something that has radically changed everyday life for most Americans. Because of this pandemic, healthcare has become the centerpiece of the national agenda, and with the spread of misinformation, it is important to understand the healthcare plans of the presidential candidates going head-to-head in November in order to decide who has the best scheme in a time when healthcare is so essential.

Joe Biden – ACA 2.0: Public Insurance With a Dash of Private Plans For Added Taste

Former Vice President Joe Biden has taken the former president's brainchild, the Affordable Care Act (ACA, a.k.a. "Obamacare"), and is looking to expand it. His major focus is adding a public plan to compete with private health plans on the ACA marketplace that currently serves American households making incomes between 133 and 400% of the federal poverty line (FPL). This public plan was part of the original plan for the ACA, but was dropped as a compromise by Democrats in 2010 [1].

Biden's plan would expand healthcare coverage to 97% of Americans, a 5.5% increase from today. For instance, almost 5 million Americans living in states that have not expanded Medicaid would receive free access to the new public option [2]. Biden's proposed expansion of the public option would also benefit low-income families who receive insurance through their employers [3]. He claims that "no family buying insurance on the individual marketplace, regardless of income, will have to spend more that 8.5% of their income on health insurance" [3]. This would reduce the cost of insurance premiums for many people, but roughly 160 million Americans with employer-based health insurance would still face high deductibles and copayments [3].

Biden's plan would cost approximately \$750 billion over a decade and would be funded by reversing some of the tax cuts instituted by the Trump administration [1]. Biden proposes eliminating capital gains tax loopholes for the extremely wealthy, but this alone may not be enough. Raising taxes for the middle class will likely be a necessary addition [3]. Biden plans to increase the number of Americans on the insurance market that qualify for premium tax credits from those under four times the federal poverty level (~ \$100,000 for a family of four) to all consumers on the individual insurance market, allowing people to purchase cheaper health insurance plans. Biden would also allow Medicare to directly negotiate drug prices and allow prescription drugs to be imported from overseas. He plans to have the Department of Health and Human Services establish an Independent Review Board, similar to NICE in the United Kingdom, that will link the price of specialty drugs to the average price in other countries [3]. Additionally, Biden plans to cap most increases in drug prices at the rate of inflation [1].

Biden also hopes to target health issues on social and economic levels. By incorporating Roe v. Wade into federal law and restoring federal funding for Planned Parenthood, he plans to expand access to abortion and contraception [1]. He also plans to tackle surprise billing (unexpected large medical bills) and the healthcare market concentration that has occurred over the past ten years [3]. Other plans include doubling the investment in community health centers that help reach underserved populations and allowing undocumented immigrants to purchase coverage in the ACA marketplaces, albeit without any federal subsidies [3]. It is also important to note that Biden has also been outspoken about mental health care and substance use treatment [3]. He has particularly mentioned encruign enforcement of mental parity laws, expanding national funding for mental health services, providing grants to states for substance use disorder prevention and recovery efforts, and investing in school mental health professionals [4].

Larry Levitt, the executive vice president of health policy for the Kaiser Family Foundation, applauds Biden's plan to use the ACA as a building block as "the quickest way to get more people insured and improve affordability, while not disrupting coverage for those who already have it" [3]. Yet this health insurance plan faces opposition on both sides of the aisle as either being too radical or not radical enough, depending on who you ask. While his plan does not overtly take on powerful health industry groups, it still faces backlash from hospital lobbyists, pharmaceutical companies, and private health insurance companies for its indirect effects of reducing their revenue and market share. While Biden's plan seems like a natural extension of the ACA, it will surely shake things up in terms of funding for the proposed changes.



Bernie Sanders - All for One and One for All. . . As Long as that One is Medicare

At the time this article was written, Bernie Sanders was still a Democratic presidential candidate. Sanders has since dropped out and endorsed Joe Biden. This section details Sanders' plan as it was proposed when he was still in the race.

Joe Biden's plan, though Democratic, isn't nearly as radical as the plan of his former opponent, Bernie Sanders. Just as Colonel Sanders revolutionized the fried chicken industry in the mid-1900s, Senator Sanders aimed to revolutionize the US healthcare system. Sanders went further than the expansion of coverage Biden proposed to cover all Americans. According to his website, Sanders aimed to "create a Medicare for all, single-payer, national health insurance program to provide everyone in America with comprehensive healthcare coverage free at the point of service" [5]. He pledged to reduce healthcare costs and eradicate healthcare corruption in America, offering universal coverage with "no networks, no premiums, no deductibles, no copays, [and] no surprise bills" [3]. The Medicare coverage offered would include dental, hearing, vision, long-term care, in-patient and out-patient services, mental health and substance use treatment, reproductive and maternity care, and prescription drugs [3]. Additionally, Sanders would cap outof-pocket costs for prescription drugs at \$200 annually for all Americans in order to "stop the pharmaceutical industry from ripping off the American people" [3]. Through his plan, he would also have wiped clean the \$81 billion of medical debt 79 million Americans owe [5].

Similar to Biden, Sanders proposed that people still be allowed to keep their doctors and that preexisting conditions would remain covered [3]. Also similar to Biden, Sanders is also a defender of abortion and reproductive rights, outspoken about the importance of mental health care and substance use treatment, and a supporter of undocumented immigrants' right to healthcare coverage [3].

While Sanders' plan sounds pretty groovy and seems to be the healthcare equivalent of Santa dropping off a whole sack of presents at each American household, it comes with a few major concerns. One fundamental problem is the juxtaposition between our capitalistic society and the overtly socialist implications of a universal healthcare system. Given America's \$24 trillion debt, having the federal government pay for the entirety of the nation's medical expenses may be unrealistic [6]. The funding to reduce costs across the board is said to come from increasing taxes on the wealthy but even still this ambitious plan may not have enough traction to fund all of its promises. Thus, while out-of-pocket costs would significantly decrease, annual tax burdens would likely increase. Higher-income, healthy people will likely pay more than they do now but lower-income, sicker people would probably end up paying less [3].

Furthermore, such a plan would not allow Americans to opt out – it's the Sanders way or the highway. While it may be important for Americans to save money, one of our countries' founding principles is that of freedom, including the freedom to make choices. Many Americans do not trust the government and feel trapped without options. While Sanders' Medicare for All is an unlikely goal for our foreseeable future, it is important to note that such a plan would be implemented stepwise which would not result in a gap in care. The first steps in such a transition

might look similar to Biden's plan with an expansion at a later time to cover all Americans. When selecting a presidential candidate, we inherently acknowledge that not all of their plans will come to fruition during their presidency. Rather, we are voting for their character and the vision the candidate has for our country's future. That being said, even the use of the public option as a stepping stone to Medicare for All would be extremely difficult to pass, even if the Democrats were to sweep the election. Garnering bipartisan support at any point in time for such a radical plan as Sanders' will prove to be an uphill battle of Everest-like proportions. Not only that, the private health insurance companies can be expected to fight tooth and nail against such a policy that takes their sizable chunk of pie away and leaves them with an empty plate instead. Indeed, you can bet that while he was still in the race, Sanders was looking at the potential healthcare battle ahead of him just as a transfer student on West Campus looks at the slope for the first time and weighs the effort needed in order to make it to class on time. While he wasn't able to pull it off this election cycle, if his plans succeed in the future, all Americans would be able to rest assured knowing that their healthcare will be taken care of. The same cannot be said of some of the other candidates' plans.

Donald Trump - The Economy Always Wins

In recent weeks, president Trump has taken hits left and right about his handling of the COVID-19 crisis. His major slip-ups included putting the non-medical Mike Pence in charge of the outbreak response, calling coronavirus the "China virus," having disbanded the pandemic response taskforce some years back, and spreading false medical information in order to keep stockholders happy [7]. While the pandemic is clearly not Trump's fault, recent polls show 52% of Americans are disappointed with the job his administration has done to combat the virus [8].

If you look at Trump's campaign website, it is full of past achievements in the healthcare field from his time in office. Yet there is little that points to future plans or goals for a second term. Therefore, the focus here will be on what has been accomplished by the Trump administration. The one major item on the docket is the one that has haunted Trump throughout his presidency — his goal to repeal the ACA. This possibility has been limping through the federal court system and currently lies in the hands of the Supreme Court, who are likely to make a decision later this year. This has far-reaching implications, as it would hit particularly hard in communities currently covered by the ACA's Medicaid expansion as well as those with pre-existing conditions who might not be able to afford or enroll in a new plan. Even individuals with employer coverage could be affected by having lifetime caps added to their coverage or higher out-of-pocket costs. Another major issue with trying to repeal the ACA is that there is not another publicly available replacement plan in place in case the law is struck down. Despite these factors, there have been numerous attempts to repeal the ACA through legislation. When these attempts have failed, the Republican Party has turned to making backdoor changes and alterations to the law that chip away at it bit by bit [9].

Trump has expanded the availability of short-term, limited coverage plans, which lower premiums for those who are healthy, but make coverage less accessible and less comprehensive for those who are sick. His administration also cut funds for marketing campaigns that alert people about ACA open enrollment periods. Trump added Medicaid work requirements and announced a plan to convert part of Medicaid into block grants, or fixed federal grants based on Medicaid funding in each state. The Trump administration also implemented an immigration rule that frightened and confused families into unenrolling children who are US citizens from Medicaid and the Children's Health Insurance Program (CHIP) [8,9].

In a more positive light, Trump signed the bipartisan Tobacco-Free Youth Act to raise the nationwide age for purchasing tobacco and vaping products to 21 years old. Trump also claims to have put pressure on China to crack down on fentanyl manufacturers sending their products into the US, which would help reduce the levels of opioid addiction in the United States. The results of this and other drug abuse efforts remain to be seen [9].

While the economy might have been maintaining steady growth and low unemployment during Trump's presidency until the beginning of the recent pandemic, there has been a rise in uninsurance rates since 2016. People who are underinsured or uninsured due to Trump's rollback of the ACA face high bills for hospital stays due to COVID-19. Sadly, their stories have discouraged others from getting screened and treated, further complicating the health crisis [10].



It's a Donkey...It's an Elephant, It's...????

Healthcare has become a bigger part of the agenda in recent years and both parties are trying to find the best combination of offense and defense to solidify their campaigns. Just as the World Cup turns every American into the biggest soccer fan alive, despite not knowing a single player on the national team, the COVID-19 pandemic has shifted Americans into healthcare aficionados. While both candidates propose their own plans, this public discussion will undoubtedly lead to shifts in stances and the fine-tuning of arguments in the coming months. Yet, while politicians continue to argue over which policy would best serve their interests, Americans are struggling to survive a pandemic. One thing is certain — donkey or elephant — whichever party eventually wins the ultimate race, the lion's share of the impact will be felt by Americans, the guinea pigs of a political, economic healthcare machine.

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How Language Barriers are Still Promoting Health Disparities By Jessica Huang '22



Have you ever struggled to deliver an awkward, choppy phrase in an attempt to ask for help in a foreign language? Many patients have that same experience when they seek medical care due to inadequate or absent interpreter services. Despite existing translator tools, such as over-the-phone translation or video chats using iPads, many patients still report unsatisfactory experiences with translator services. This is worrisome, as it can lead to inadequate care and medical errors.

As many as one in 10 working adults in America has limited English proficiency, and yet only 56% of American hospitals offer some kind of translation service [1]. Although hospitals are required to ensure "meaningful access" to services so patients can make informed health choices, this protocol is clearly not being followed.

Dr. Alexander Green, a physician and associate professor at Harvard Medical School, believes that the problem starts from a culture that "value[s] efficiency over effective communication." In an emergency department, which is especially fast-paced, it is easy for doctors to overlook symptoms and accidentally prescribe medicine that could be detrimental, or miss critical signs of a larger problem — and this issue can be greatly exacerbated by a language barrier. This happened to a nine-year-old Vietnamese girl who was rushed to the emergency department with a case of the stomach flu. She was prescribed a drug not recommended for children, and the staff spoke and wrote instructions in English that her parents should bring her back to the hospital if she experienced side effects — except that her parents didn't speak English, and the doctors didn't use a translator at any point during the interaction. At home, she suffered a heart attack from the drug and died [1]. This example of malpractice is actually not uncommon. In 2010, out of 1,373 malpractice claims studied, 35 were related to inadequate access to a translator [1]. These negative experiences can discourage patients from seeking healthcare in the future, which can only further exacerbate health disparities which already exist in immigrant and low-income communities. Translation gaps can also lead to other adverse outcomes, such as an increased hospital readmission rate. Clearly, neglecting the need for effective communication in favor of efficiency can lead to horrific outcomes.

Hospital translator services should be offered as a default to any patients who might not speak English fluently. Similarly, the first priority for these improvements should be to elevate patient care. For some hospitals, the appeal of shifting to iPads from over-the-phone translation was predominantly for efficiency, because these chats take "half the time of a phone call" [2]. Also, the systems implemented must not only be present but must also work well. Patients have said that inperson interpreters are superior to over-the-phone because a phone cannot convey body language or cues [3]. In addition, the translator's voice can become choppy, disconnected, and unclear if phone service is poor. It is disappointing to hear that even in 2020, many hospitals have not taken the initiative to integrate more successful translator systems.

As the leading country in healthcare technology, the US should increase services that align with their patients' needs. By normalizing translation, hospitals can begin implementing them consistently. This should include not only employing qualified interpreters, but also providing translated paper resources about medication or treatments. With these steps in place, hopefully patient care can rise to a standard that meets the needs of different populations across the country.



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Autism Spectrum Disorder: Behavioral Treatment Approaches and Ongoing Research By Carina Garcia '23

The CDC estimates that one in 59 children is diagnosed with Autism Spectrum Disorder (ASD). A lot is still unknown about ASD, and research about risk factors and causes is currently underway — but what is still least understood is the best behavioral interventions for the disorder.

ASD is a behavioral disorder characterized by impairments in social interaction and language development. People with ASD display less emotional and interactive reciprocation, as well nonverbal communication, in conversation. According to the latest Diagnostic and Statistical Manual of Mental Disorders, or DSM–5, ASD is identified by a pattern of repetitive, restricted behaviors or interests (RRBs) in the following categories: (1) difficult adjustment to change, (2) limited range of interests, (3) repetitive behavior, and (4) extreme reactions to environmental aspects. Considering the range of RRBs that may appear in each individual, only two of the four RRB categories must be evident for diagnosis [1].



In recent years, the criteria for ASD diagnosis has been adjusted. Previously, ASD diagnosis excluded the possibility of being diagnosed with other disorders, but this requirement has since been removed. This change in diagnostic criteria has been most significant for ASD people with ADHD diagnoses, as the conditions can often be comorbid [1]. While there has been progress in understanding ASD, further research is needed to develop adequate treatment. Currently, there are numerous treatment plans available for children that accommodate their different behavioral patterns, with respect to their level of social interaction and motivation to learn. The general goals for these treatments include improvement in attention, social reactions (i.e., coping with frustration), and communication skills [1]. Some of these approaches involve direct instruction, which incorporates specific targets for the children to focus on in each lesson in a small group setting. For example, this method might involve caregivers using a fun and playful interaction to prompt children to speak, with simpler words and the use of hand signals, about topics relevant to them. The main difference between this technique and the other main techniques like Discrete Trial Teaching (DTT) and echolalia, where children are prompted to repeat words and sentences, is that direct instruction aims to improve the child's social development and decrease disruptive behaviors with continuous feedback [2].

When developing interventions, one factor that can increase effectiveness is the duration of the child's learning experience, as a longer course may assist in the improvement of their social behaviors. Improvements in language and communication have been demonstrated in studies conducted for more than five years, especially in children who receive early treatment between the ages of two and three years. Evidently, current programs mainly target children in their early stages of development, and many intensive treatments are not maintained as these children grow older. Thus, neurological assessments and research opportunities are halted as the child gets older and is placed in an 'appropriate' educational setting. It is clear that there is still a gap in research regarding the relationship between an individual's social behavior and their age range [1].

Other factors that contribute to a treatment's effectiveness include the caregiver's skills (i.e., communication, confidence, and relationship with the child), the economic status of the child's family, and parental engagement in treatment sessions with the caregiver [1]. Nerea Jayo–Schielke, a licensed clinical social worker for the Jersey City Board of Education with eight years of experience working with children and adults with developmental disabilities, commented on the importance of a caregiver's abilities. She said, "It enhances the social functioning, consistency both at home and school...[A] caregiver's ability is to be knowledgeable, practice and implement the intervention on a consistent basis to hopefully make an effective behavioral change" [3]. A caregiver's abilities are crucial to their child's behavioral changes, and such improvements can only be brought through consistent intervention. Jayo–Schielke also commented that an integral part of a caregiver's job is their control over a child's self-stimulating behaviors, like arm flapping and jittery movements. As opposed to traditional teaching methods of punishment or scolding, caregivers teach the children "replacement behaviors... [to] build self esteem and [reduce] anxiety" [3]. Therefore, the role of a caregiver is integral to the efficiency of the treatment and ultimately promotes their student's social behaviors while providing corrective feedback.

The role of a parent is not solely focused on the child's treatment at home, but also extends to active contribution in treatment sessions. Zinia Melendez, a social worker in New Jersey, said that during intervention sessions, parents should be actively involved in learning how to engage with their child, especially in ways that can minimize their self-stimulatory behaviors [4]. Early intervention programs help parents learn more about triggers that cause specific behavioral responses for their child and the proper ways to address these reactions. Aside from a parent's motivation to be involved in the sessions, the economic status of families may play an even greater role in their child's learning experience. Javo-Schielke commented on this socioeconomic gap, noting the expensive costs of these intervention programs, most of which are paid out of pocket. She also highlighted the disparity that these costs create between families who can afford the services and are more consistent with the interventions compared to families that are not economically stable and cannot afford to keep their child in these programs [4]. Melendez affirms these sentiments by noting the correlation between economic status, education, and social mobility she has recognized among families of children with ASD. She recognizes that higherincome families have the flexibility to get their children into a variety of programs, as they are able to travel longer distances and advocate for their child's medical care, educational environments, and behavioral supports [4]. Evidently, a child's access to such programs is dependent on family income levels.



Although behavioral intervention research about ASD is still ongoing, existing programs are steadily focused on providing individuals with optimal learning opportunities and promotion of prosocial behavioral programs. Additional research could further examine the effectiveness of direct instruction methods for children with ASD. Also, other methods for more families to receive these treatment plans could be optimized in the future, depending on the programs offering specific treatments and their accessibility. While there has been progress in understanding ASD, further research with specific treatment plans and their availability to all children that require them is still underway and continuously being improved.

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Gentrification: Leaving Homes, Happiness, and Health Behind By Sakura Eguchi '22

Today, one's ZIP Code may serve as a stronger indicator of health status than one's genetic code. Many Cornell classes discuss how biological factors, such as one's diet, physical activity, and genetic composition, influence health and prognose the probability of developing chronic diseases. In these same classes, the health implications of environmental factors are unfortunately understated or ignored. Affordable transportation, adequate and safe housing, high-quality education, and a steady food supply are just a few examples of fundamental social determinants of health.

Gentrification is a particularly prominent environmental factor with critical effects on health outcomes. The CDC pragmatically defines gentrification as "the transformation of neighborhoods from low value to high value" [1]. However, urban development has more to it than meets the eye: according to published literature, gentrification ultimately leads to reduced access to primary healthcare and results in a greater prevalence of mental health issues in those displaced from gentrified neighborhoods.

Urban areas in large cities, like New York City, are susceptible to gentrification. In a 2015 housing and neighborhoods report published by the NYU Furman Center, neighborhoods that were "low-income in 1990 and experienced rent growth above the median SBA [sub-borough area] rent growth between 1990 and 2010-2014" [2] were classified as gentrifying. Out of the 55 neighborhoods studied in New York City, 15 had undergone gentrification, seven were consistently low-income with no growth in average income, and the remaining 28 were recorded as consistently high-income. The prevalence of low-income residents coupled with rising rents constituted prime candidacy for gentrification.



Urban development, which intends to raise a neighborhood's value, attracts residents of higher socioeconomic status who can afford more expensive homes. This influx of new residents effectively displaces the original low-income residents because they either can no longer afford the increased rent or property taxes, or because they experience a culture shock due to the different cultures of new residents. The displacement of low-income residents from their homes frequently results in their settlement in non-gentrifying, low-income neighborhoods of potentially lower quality and safety relative to the original neighborhood. These changes in living areas have numerous health consequences: displaced residents suffer decreased access to adequate primary healthcare and poorer overall health outcomes. According to the CDC, residents displaced as a result of gentrification are at increased risk for numerous health issues: "shorter life-expectancy; higher cancer rates; more birth defects; greater infant mortality; and higher incidence of asthma, diabetes, and cardiovascular disease" [1].

However, the strength of the correlation between gentrification and its effect on health is ambiguous. The analysis of displaced resident movement between neighborhoods requires extensive longitudinal data along with resident tracking, which can be difficult to obtain. For this reason, few quantitative studies have been successful in examining the direct association between gentrification and adverse health outcomes amongst displaced populations. Despite these limitations, existing published studies have strongly suggested that gentrification ultimately reduces access to primary care, contributes to mental health issues, and generally worsens health outcomes.



Primary care physicians are crucial for a person's overall wellness because they are an invaluable resource for lifestyle counseling, health maintenance, and initial identification of acute and chronic illnesses [3]. In particular, access to a primary care doctor can provide the opportunity for earlier illness detection during annual visits and enable patients to learn chronic disease self-management. According to a study conducted by Campbell (2003), "a one-third increase in the supply of family [primary care] physicians was associated with a 20 percent lower mortality rate from cervical cancer" [4] in various counties within Florida. Hence, primary care has numerous benefits with the potential to increase one's longevity; its absence can be detrimental.

As a result of changing circumstances associated with gentrification, displaced residents' subsequent replacement of primary care with frequent emergency department (ED) visits often contributes to higher mortality rates. According to a national survey [5], the low-income, unstable neighborhoods to which displaced residents move may lack the resources required to provide adequate primary care, or existing facilities may be unable to meet the residents' medical needs. Consequently, a local emergency department becomes the displaced residents' main source of care. Based on a recent study conducted by Lim et al. (2017), it was determined that adults who had moved to lower-income, non-gentrifying neighborhoods from gentrifying areas had a "greater number of ED visits [and] hospitalizations . . . for about five years after displacement" [6]. This repeated ED use is extremely dangerous in the long run because, without a primary care physician, people cannot effectively and frequently monitor their health status. Although emergency departments are equipped to treat acute illnesses, they may not be able to aid in the prevention of diseases such as heart attacks, diabetes, stroke, and various cancers, thus increasing displaced residents' mortality rate. Similarly, they are not the preferred mode of treatment as they are more expensive than primary care and may cause delays in treatment for true emergency cases.

Moreover, a move to another non-gentrifying, low-income community may expose the displaced residents to unsafe criminal activity that may negatively impact their health. For example, a study that analyzed the relationship between broken windows and behavioral health among low-income African American adolescents discovered that African American adolescents inhabiting neighborhoods with poor living conditions experienced a higher rate of "mental health problems, delinquency, substance abuse, and unsafe sexual behaviors" [7]. Evidently, the prevalence of high rates of criminal activity and unsafe living conditions, often found in low-income communities, contributes to an increased propensity for engagement in dangerous behaviors that put residents' health at risk.

In addition to a marked decrease in primary care access and risky behavior engagement, gentrification may engender mental health issues within displaced residents. Undergoing displacement in any situation, such as after natural disasters, predisposes affected individuals to a phenomenon known as "root shock" [6]. When people encounter a significant shift in their environment (i.e. moving) that alters their social networks and daily routines, they often experience greater stress levels and are more likely to develop mental illness. For instance, a study conducted after Hurricane Katrina found that "residents who had to relocate...and could not return to their original community experienced higher general psychological distress and perceived stress as compared with residents who were able to return" [8]. Even in the absence of gentrification, people who are dislodged from their initial homes experience a detachment from their original neighborhoods, which may potentially lead to distress, anxiety, and depression. Moreover, another research study examining the prevalence of anxiety and depression in displaced children discovered "a 1.56-percentage-point increase (8.69 percent versus 7.13 percent; p<0.01)... of anxiety or depression among those who started out in areas that rapidly gentrified relative to those in areas that remained low SES" [9]. Hence, it is clear how gentrification produces a similar effect on residents' mental health as those forced to relocate for different reasons.



Gentrification's adverse effects on mental health and primary care access undoubtedly demonstrate how one's environment has a notable influence on one's overall health. Although taking into account one's diet, lifestyle, and genetic background is critical when evaluating health status, a person's environment is just as important to consider. By increasing the general public and healthcare providers' awareness of gentrification's health effects, we can provide additional resources for mental health support in low-income neighborhoods that can reduce displaced people's psychological stress and create changes that reduce the prevalence of gentrification and displacement of low-income residents. Moreover, healthcare providers can gain a more holistic understanding of all the potential factors influencing a person's health and subsequently make a more informed decision regarding disease prevention and treatment.

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Jogging and Gestation By David Rusakow '22



For many pregnant women, the desire to ensure a healthy baby can expand into every area of life. This can include changes to their schedule, diet, and even living space. Yet, one key change remains forgotten by many women: exercise.

Recent literature has continued to emphasize the profoundly positive effects that exercise can have for both the mother and the fetus. For decades, myths have swirled about how much a pregnant woman should exercise, if she should exercise at all, and what types of exercises are okay. In fact, WhatToExpect, a pregnancy lifestyle blog, suggests that some women believe that exercise plays no role other than to exhaust a pregnant mother [1]. Luckily, the literature suggests that exercise plays a much more helpful role.

A recent study following mothers during, and on average 6 years after, pregnancy suggests that exercise confers a variety of benefits. Women who exercised were found to have a reduced risk of excessive gestational weight gain, gestational hypertension, and diabetes [2]. After pregnancy, they were more likely to return to their pre-pregnancy weight and had a lower risk of cardiometabolic conditions [2]. For the child, maternal exercise during pregnancy reduced the risk of obesity during the first year along with the risk of macrosomia (fetuses growing too large) [2]. The study notes that the women that benefitted the most from exercise were those who were previously inactive [2]. It suggests that there is no better time to start exercise than before a baby. The study reinforces the benefits of exercise and illuminates the fact that not only should women continue an exercise routine during pregnancy, some should begin one.

While the benefits are profound, exercise is not a panacea. Women should pay special attention to perform at the right intensity. If the exercise performed is too intense (90% or higher of maximum heart rate), there is a concern that it may lead to dehydration and blood being redirected from the placenta to the muscles [3]. Though the profound majority of literature advocates for exercise, it is important to realize the importance of a smart and physician-approved exercise routine [3]. Similarly, women with pre-existing conditions should be cautious but can still consult a physician for an appropriate routine [4].



Luckily, expectant and new mothers should have no problems finding exercise options. A host of gyms designed exclusively for pregnant women have sprung up in cities across the nation. In fact. Chicago's Prenatal Fit is a "fitness studio that specializes in Prenatal and Postnatal Workouts" and offers classes in Yoga Basics. Prenatal Pilates, and Prenatal/Postnatal Barre [5].

In Manhattan, Fit Pregnancy Club (FPC) is a prenatal fitness studio that teaches expectant and new mothers how to "treat their body during a pregnancy" and "prepare for the rigors of delivery" [6]. They also cater to their audience with an increased frequency of breaks for water and rest [6]. These gyms also serve as a community in which women can bond over a shared experience [6]. Additionally, for those who can't make it to a physical location — such as during quarantine — exercise apps like Aaptiv have added plans specifically for pregnant women [7]. Hopefully the proliferation of companies like these can contribute to a greater acceptance of pre-natal exercise.

As the science continues to back the benefits of prenatal exercise and companies continue to offer more opportunities to engage in it, hopefully women will no longer overlook the valuable role that exercise can play in ensuring both a healthy mother and baby.

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Endometriosis and Dioxins: Uncertainty of Environment and Health Risks By Jennifer Long '22

Environmental changes have caused uncertainty regarding how the changing climate will affect our health in the future. For example, how will warming temperatures change metabolism? How will rates of cancer change with increased exposure to ultraviolet light? This concern has prompted a closer look at the effects of past environmental damage and how it has already impacted human health today. Now we wonder: how have toxins in the environment impacted women's risk of endometriosis?

Endometriosis is a painful disorder that affects one in ten women of reproductive age, totaling more than 22 million worldwide. The disorder occurs when the endometrium, the inside lining of the uterus, also grows outside of the uterus. Along with intense pain, symptoms of the disorder can include excessive bleeding and back pain during menstruation, as well as infertility [1].



Endometriosis is a complex disorder, and its pathogenesis is not yet totally understood. One hypothesis is that cells in the abdominal cavity may transform into endometrial-like cells, causing endometrial growth outside of the uterus. Another hypothesis, thought to be the most likely explanation, is retrograde menstruation. In this scheme, the menstrual blood, which contains endometrial cells, makes its way into the fallopian tubes and abdominal cavity [2], but these patients have an immune disorder in which the body does not destroy abnormal endometrial growth outside of the uterus. Thus, the cause of endometriosis is still unclear [3].

Environmental factors such as women's toxin exposure over a lifetime are known to affect the progression of the disease. Studies reveal that the high frequency of endometriosis is related to environmental exposure to toxic chemicals in the environment, termed "dioxins." Dioxins are a known threat to human health and have been an environmental concern since the 1970s. In 1979, the Environmental Protection Agency banned the dioxin category of polychlorinated biphenyls (PCBs), which were used in the manufacturing of everyday items like paints, plastics, and light bulbs [4]. Like all dioxins, PCBs are known carcinogens and are believed to cause other serious human health issues such as delays in neurological development. Unfortunately, PCBs were released into the environment for decades — for instance, General Electric regularly dumped these chemicals into the Hudson River from 1946 to 1977 [5].

PCBs and other dioxins were phased out worldwide in 2005 after the international treaty, The Stockholm Convention on Persistent Organic Pollutants, was signed by 122 nations in 2001 [6]. However, it is difficult to completely eradicate these chemicals. They remain a concern, as they exist in food products, especially fish [6,4]. Currently, 90% of human exposure to dioxins occurs through the diet.

The "transgenerational effect" of dioxins is seen today through its impact on human reproductive systems [7]. After several decades of collecting extensive data on dioxins, the accumulation of dioxins was determined to be a risk to women's reproductive health. Data shows that dioxins cause disruptions in hormone regulation, immune system function, and fertility [8]. And while women of reproductive age today have not been greatly aware of their exposure or their risk to dioxins, it may nevertheless be a silent cause of endometriosis [8].

Several studies have considered the specific impacts of dioxins on endometrial cell function. There have been indications that the changes in cell function are mostly due to the complexes that dioxins form with AhR receptors, a type of receptor that is especially abundant in endometrial tissue. These complexes have shown to increase the production of proinflammatory cytokines and chemokines, which cause the pain and inflammation associated with endometriosis [9]. Dioxins can also increase secretion of matrix metalloproteinases (MMPs), which "are responsible for the degradation of most extracellular matrix proteins during organogenesis, growth and normal tissue turnover" [10].



However, conclusions are not yet certain. Researchers looking to evaluate toxins and endometrial functions face many challenges; even in a controlled study, the inability to experiment often leads to skewed data. This has led to conflicting evidence — a recent review states, "Although the hypothesis [that environmental toxins are related to endometriosis was first] reported almost 20 years ago, studies trying to prove [the effect of] TCDDs or PCBs on the disease genesis are conflicting" [8,11]. Further studies may be able to elucidate this relationship, but for now, as there are still uncertainties about the main cause of endometriosis, there have been limited investments into research concerning the relationship of the environment to endometriosis [8].

The case of dioxins and endometriosis shows that decisions made about environmental policy should be made with an understanding of the lasting, transgenerational effects of our actions in the present. Considering the rapid environmental damage that is currently occurring, perhaps it's time to consider finding more room for making connections between disorders that harm human health and the environment.

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Neurotoxic Effects of Water Contamination By Anika Kumar '23



Water is critical for human life. However, access to clean, safe water is limited in many areas around the world. While the obvious effects of drinking unsafe water, such as an upset stomach and diarrhea, are widely known, scientists are now discovering some unexpected effects of drinking unclean water on cognitive functioning and developmental abilities. Certain neurotoxins found in water sources can affect brain development from the prenatal period through childhood, and long-term consequences can affect motor function, learning, and behavior. Children are robbed of their full potential, and lower graduation rates, increases in crime, and reductions in lifetime earnings burden both families and society at large [1]. Despite the continuous rise in awareness of the consequences of water contamination, nearly a third of the world still does not have access to safe drinking water.

Lead was the first water contaminant to be intensively studied for developmental neurotoxicity. European writers in early modern times noted that lead and mercury exposure could cause behavioral dysfunctions among metal miners. In 1977, Sir Abraham Goldberg and his colleagues released the first report to associate prenatal lead exposure with intellectual disability through an analysis of dried blood spots collected at birth [2]. After discovering that the source of this lead exposure was drinking water contaminated by storage in lead-lined tanks, public health officials began instituting regulatory controls on the use of lead in house paints and gasoline.

Apart from lead, a wide range of developmental neurotoxins (DNTs) in water can cause severe mental impairment. One way some DNTs enter the human body is through ingestion through certain foods. Arsenic and mercury, for example, contaminate food through bioaccumulation in fish and uptake from irrigation water by food crops like rice [3]. Other common facilitators of exposure to DNTs include the use of toxic metals in water delivery systems and physical contact with geological formations [4].

Even fetuses can easily be exposed to DNTs through exposure to harmful substances in maternal blood. These substances are carried across the maternal-fetal barrier by hijacking proteins that regulate the availability of essential trace elements [5]. In healthy adults, on the other hand, natural geologic sources are largely responsible for contamination of water and resulting impairment of cognitive function. Previous studies of adult workers in manganese mining and smelting concluded that exposure to toxic metals resulted in both cognitive and neuromotor deficits [6]. Such effects were also found in children in one longitudinal study of prenatal manganese exposure in Korea. The study revealed that both high and low manganese concentrations in maternal blood were associated with poorer performance in children tested for early learning at age six [7].



Exposure to DNTs has been found to significantly reduce IQ scores and often results in behavioral changes such as shortened attention span, hyperactivity, and generally reduced overall performance [8]. Many studies also claim that there is a significant association between early toxic metal exposure and violent behavior [9]. For example, lead exposure through drinking water among preschool-age children may be linked to higher measures of impulsivity, anxiety, and antisocial tendencies that predict criminal behavior. Accordingly, studies conducted across a variety of nations have reported crime rates that directly correlate with average blood lead concentration in infants (with time lags) [10].

After the discovery of the effects of water contamination on cognition, behavior, and motor function, researchers, policymakers, and grassroots organizations around the world began implementing a variety of policies and programs to aid in the improvement of water quality and accessibility. For example, the United States passed the Clean Water Act, and since 1972, \$1 trillion has been spent by the government to reduce water pollution [11]. New policy is frequently implemented as a result of ongoing epidemiological research revealing new information about known toxicants. In developing nations, for every \$1 invested, there is a projected \$3-\$34 return in economic development [12]. Such promising outcomes have prompted change at the household level with the introduction of ceramic filters and chlorine tablets through collaboration with the private sector and social marketing techniques. Additionally, the United Nations decision to include clean water accessibility in its list of sustainable development goals has inspired community efforts and policy changes around the world [13]. It is hopeful that these efforts and an increased awareness of the importance of clean water will continue to foster change on a global scale.

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The Marriage of Climate Change and Disease By Avalon Monti MPH '21

The connection between environmental health and human health has been overt since the turn of the decade. The increasing prevalence and severity of infectious diseases has been an overlooked consequence of climate change. The World Health Organization has recognized only Dengue and Malaria as "climate-sensitive infections" [1], but many other diseases transmitted by invertebrate and vertebrate animals, known as zoonotic diseases, are expected to rise due to drastic changes in weather and variation in the host or vector populations [2].

The number of disease vectors is dependent on the conditions of their breeding sites. Increases in rainfall have been associated with increases in vector populations for dengue, malaria, Rift Valley fever, and hantavirus [3] because the weather creates marsh-like environments with tall grass where mosquitoes and mosquito larvae thrive. The increase in precipitation has occurred across the globe, but especially in the Americas with El Niño Southern Oscillation, a warming of the Pacific Ocean that leads to flooding and rains. With this, there has been a dramatic increase in mosquito populations, a vector for malaria, and North American deer mice populations, a vector for hantavirus. As a result of the increased vector population, cases of malaria and hantavirus were significantly higher in years with El Niño events [3].



Hosts and vector species are often constrained to a particular environment. As temperatures rise and ecosystems shift, both hosts and vectors will adapt their migration patterns to fit the new environments. Depending on the mobility of a species, they will migrate at different rates, which can lead to population increases in areas that certain species are not commonly found in, as well as population decreases in certain areas as new predators move in [3]. As hosts and vectors are introduced into new environments, human diseases can emerge in regions that have not historically experienced any cases of that particular disease.

Numerous diseases are emerging in areas that they have not been recorded before. However, the growing severity and frequency of zoonotic disease outbreaks as a consequence of climate change can be mitigated. If humans take action now to reduce their carbon footprint, we can reduce the impact of changing weather patterns and temperatures on the spread of disease.

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The Opioid Crisis: The Moral Dilemma Faced by Doctors In The Age of Powerful Pharmaceutical Companies By Kazi Tasneem



The opioid crisis began in the mid-1980s and early 1990s with misinformation and spiraled out of control as false reassurances about the safety of opioids were spread by pharmaceutical companies and medical experts. Prior to the start of the crisis, physicians were extremely reluctant to prescribe opioids for anything apart from severe pain, such as pain associated with cancer or terminal illness, given existing fears around the addictive properties of these compounds [1].

It is safe to assume that a person makes the choice to become a physician with the intention to serve people as honestly and sincerely as they can, which justifies concerns around prescribing opioids. However, since pharmaceutical companies have been rightfully placed at the center of this crisis, the inadvertent role played by physicians deserves to be studied in greater detail. The purpose of this examination is not to place the blame on physicians, but to try to understand the pressures they face in their pursuit to provide quality care for their patients.

Opioids were traditionally only prescribed in the most severe cases, but there was an increasing demand to prescribe them to patients experiencing minimal pains. Studies found that pain was being inadequately treated, which pharmaceutical companies soon began to capitalize on in the 1980s in order to generate greater profit [1]. In 1995, Purdue Pharmaceuticals produced OxyContin and, following FDA approval, began aggressively marketing the drug, while greatly downplaying its addictive potential [1]. Consequently, the annual number OxyContin prescriptions increased from 670,000 to 6.2 million between 1997 and 2002 [1].

In 2001, new standards were established that called on hospitals to conduct systematic assessments of patients' pain levels frequently while hospitalized [1]. Additionally, patient satisfaction was used as a tool to qualitatively judge a hospital's ability to administer quality care [1]. The 2010 Patient Protection and Affordable Care Act then expanded the role of patient satisfaction by incentivizing hospitals to submit their patient satisfaction surveys with payments if the hospital scored well [1]. Many conscientious doctors received poor scores because they did not prescribe opioids when their patients requested them, which proved discouraging for many doctors [1]. In

addition to these legal pressures, companies such as Purdue Pharmaceuticals also funded patient advocacy groups, physicians, and professional medical societies to promote the prescription of opioids for all types of pain [4]. All of these factors led to an emerging new norm where doctors were highly encouraged to prescribe opioids for even common pains.

In his article The Opioid Epidemic: It's Time to Place Blame Where It Belongs, physician Ronald Hirsh admits that many well-meaning doctors, including himself, fueled the abuse of opioids by trusting companies such as Purdue Pharmaceuticals and ultimately overprescribing pain medication in the hopes of providing relief to their patients [3].

Pharmaceutical companies are undoubtedly at fault for misadvertising their drugs, but doctors, who have no way of verifying claims made by these companies but want to relieve the suffering of their patients, sometimes have no choice but to trust these companies.

Although most doctors are well-intentioned, unfortunately there are a few doctors who care more about making money than they do for their patients. Companies paid some doctors, such as esteemed anesthesiologist Russell Portenoy, to promote their drugs to increase the perceived legitimacy and safety of these drugs among physicians [4]. Additionally, some unscrupulous doctors prescribe pain medication to those who ask for it, regardless of whether the person actually needs it, motivated by financial gain [3]. In his article, Arthur Gale discusses the dangers of an increasingly commercialized health care system where physicians and researchers publish research funded by pharmaceutical companies, as this can create a strong conflict of interest [2].

The opioid crisis, which has been described as an epidemic by many, is very much ongoing and a challenge the nation must tackle. One lesson to be learned from this crisis is that the unchecked power of pharmaceutical companies not only makes them wealthy at the expense of innocent people's lives, but it also causes well-meaning doctors to fall prey to false advertising of drugs. This endangers the very purpose that physicians strive to work for: to best care for the people who depend on them.

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Putting Restlessness To Rest By Nelson Liu '23



Poor sleep quality, fueled by sleep disorders and circadian disruptions, is rampant in the technological age. With sleep deprivation so pervasive in our communities, the science suggests that preventative nutrition may be a promising treatment. This article will investigate magnesium supplementation as a cure to restless nights and groggy mornings.

Sleep cycles, blue light, and circadian disruption are buzzwords that are thrown around quite a bit. The popularity of such phrases speaks to the pervasiveness of poor sleep quality in our culture, which may not come as such a surprise when we consider the adverse effects of modern practices like prolonged screen time before bed and substantial caffeine intake [1].

Traditional pharmaceutical recommendations for insomnia include alcoholic nightcaps and overthe-counter (OTC) sleep aids, such as melatonin or benzodiazepines. And while studies have shown that OTCs are generally not physically addictive, psychological dependencies may commonly develop in users [2]. This makes sense, as people are tackling the problem of chronic sleep deprivation or sleep illness with a chronic treatment — an insomniac whose sleep improves after using sleep aids will naturally continue to use them. However, many of these OTC prescriptions, like melatonin agonists, are not meant to be used continually. In fact, because melatonin is a hormone, which humans already endogenously produced, its prolonged consumption may lead to a disruption of the body's internal melatonin metabolism, leading to a diminished effect over time [3].

Whereas pharmaceuticals excel at treating acute infectious diseases with painkillers and antibiotics, chronic sleep disorders may warrant a more natural remedy. Magnesium, a micronutrient and mineral, has taken the spotlight in recent peer-reviewed scientific literature. Calcium and magnesium ions in the body allow muscles to contract and relax, respectively. Magnesium also serves as a cofactor in over 300 enzymatic reactions throughout the body ranging from vitamin D activation to DNA repair [4]. It would make sense that a mineral supplement that supports the body's innate repair mechanisms could be healthier and more sustainable than OTC medications.

A double-blind randomized clinical trial published in 2012 involving 46 elderly participants found that a 500 mg magnesium supplement daily resulted in increased sleep time, sleep efficiency, and melatonin production, and a decrease in time needed to fall asleep [5]. It is important to note that 500 mg is above the Upper Tolerable Limit (UL) for magnesium, but this dosage is still safe because not all of the magnesium dosage is absorbed [7].

Another randomized clinical trial published in 2019–-much more recently–-involving 60 participants diagnosed with insomnia, supplemented an experimental group for 3 months with a magnesium–melatonin–vitamin B complex. The severity of insomnia was reported using the Athens insomnia scale (AIS), and the experimental group showed significant improvement in sleep outcomes. The supplement given contained 175 mg magnesium oxide and 1 mg melatonin [6]. As the study duration was 3 months, the design may suggest that added magnesium to small doses of melatonin may allow for a more prolonged and sustainable remedy, a compromise between pharmaceutical and naturopathic approaches.



Whatever the case may be, evidence suggests that for those who are concerned with long term effects of pharmaceutical sleep aids, magnesium supplementation may be a gentler alternative to sleep restoration. To that extent, a daily dosage below 350 mg [7] may be helpful for those who do not consume high amounts of dietary magnesium. Beyond supplementation, increasing consumption of magnesium foods like leafy greens, nuts, and legumes, may be an even more naturopathic approach.

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Antibiotics Right Under Our Noses By Jessica Dai '22

Ever had a problem, and found the answer to be right under your nose? Microbiologists from the University of Tübingen in Germany have recently discovered the antibiotic lugdunin produced by Staphylococcus lugdunensis, a bacterium found right in the human nasal microbiome. The search and discovery of lugdunin led to a new class of fibupeptide, a type of peptide (short protein) that impairs the energy supply of bacteria cells, with exciting applications in combating the antibioticresistant bacterium Staphylococcus aureus [1].

S. aureus is behind the notorious methicillinresistant S. aureus (MRSA) infections. These infections, which initially occur on the skin, can burrow deep into the body and cause potentially life-threatening conditions by affecting the bones, bloodstream and lungs. Most infections occur in health care or hospital settings. Nursing homes are also dangerous due to a susceptible elderly population and rapid spread by skin-to-skin contact. They are particularly dreaded in hospitals where the bacteria can infect immunocompromised patients and those who receive surgery [2,3].



Because MRSA is already resistant to common antibiotics, researchers have begun to search for other treatments. One such treatment is the antibiotic lugdunin, produced by the bacterium S. lugdunensis [4]. This antibiotic is a fibupeptide, a new class of antibiotics that was discovered in early 2016. Though not much is understood about this group of antibiotics, it is known to disrupt the electrical potency of biomembranes.

"Each bacterial cell requires a so-called membrane potential to live. This means that a pathogen needs different concentrations of electronically charged particles in the cell compared to its surroundings," explains Dr. Nadine Schilling, a chemist who was part of the research group at the University of Tübingen. "Fibupeptides like lugdunin are able to transport positively charged hydrogen ions across the membrane and consequently dissipate this membrane potential, resulting in a kind of energy standstill." As a result of the membrane disturbance, the bacterial cells die and the infection stops [5].



Even more intriguing is that the antibiotic effect of lugdunin does not rely on spatial (chiral) interactions like many other antibiotics. For example, if a mirror image structure (enantiomer) of lugdunin were synthesized, the antibiotic would remain effective. This lack of structural reliance allows S. lugdunensis to be especially good at avoiding bacterial resistance. In fact, the laboratory has yet to find a method to resist lugdunin.

"Consequently, there is an enormous interest in new antibiotic structures like lugdunin and in their modes of action," emphasizes Stephanie Grond, Professor for Organic Chemistry and Natural Compound Research at the University of Tübingen [5].

Though the newly discovered antibiotic appears promising for treating MRSA infections, extensive preclinical and clinical trials are required to understand whether lugdunin can be used as a therapeutic agent in the future. It is currently unknown whether fibupeptides are safe and effective for the treatment against MRSA infections in humans.

But for now, there have been many people who may have benefitted from the production of the antibiotic in their nose without even knowing it. In the study, researchers checked the nasal microbiomes of 187 hospital patients in University Hospital Tübingen in Germany and only 17 patients with S. lugdunensis carried S. aureus concurrently. Meanwhile, two-thirds of people without S. lugdunensis carried S. aureus. All of the hospital patients' S. lugdunensis colonies produced lugdunin [1].

Despite the human microbiome being an unknown territory, new findings like these inspire researchers to explore the most unexpected places in our body for antibiotics, even if it is right under our noses.

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FGF 21: An Agent Of Change For Metabolic Disease By Lauren Rivera '22



In a 2019 study from The New England Journal of Medicine, public health researchers from Harvard and George Washington University found with high predictive accuracy that, by 2030, nearly one in two adults in the United States will be obese (BMI \geq 30) [1]. Obesity is a nationwide epidemic that is harmful to human health and its prevalence is growing at an alarming rate. Being obese increases the risk of heart disease, diabetes, stroke, and even some forms of cancer, all leading causes of death in the United States [2]. In the midst of the COVID-19 global pandemic, it is especially important to highlight that people with these conditions are at a higher risk for both contracting and suffering severe illness from the virus [3]. Whether in a pandemic or not, obesity disrupts the efficacy of numerous organs and internal systems, leading to metabolic dysfunction and increased mortality.

Regulation of body weight is a complex process not entirely understood by scientists. Interrelated hormonal pathways, environmental factors, and genes that affect energy homeostasis are still being discovered, making it difficult to identify a specific treatment for obesity-induced metabolic syndrome. Metabolic syndrome is a condition in which patients present with a cluster of comorbid conditions such as hypertension, hyperlipidemia, and hypercholesterolemia, and are at increased risk for serious disease. Currently, there is no single treatment that is able to address multiple conditions of obesity-induced metabolic disorder at the same time. Multiple medications must be combined as a treatment strategy, causing undesired side effects and low patient compliance. On the forefront of research, fibroblast growth factor 21 (FGF21) has emerged with promising potential as a therapeutic agent to combat obesity and multiple associated metabolic diseases [4–6].

The fibroblast growth factor (FGF) family is a group of signaling proteins that regulate a wide variety of biological functions. There are 22 known members of the FGF family, and studies over the last decade suggest that FGF-mediated pathways occupy an important role in regulating endocrine tissues and metabolic processes, such as those involved in the regulation of food intake and body weight [7]. The FGF21 gene was originally discovered in mouse embryos in 2000 [8] and, in 2005, was proposed to be a metabolic regulator and a potential antidiabetic drug [6]. Subsequent studies conducted on ob/ob and db/db mice — animal models for hyperglycemia and insulin resistance — found that injections of FGF21 led to significantly reduced plasma glucose, comparable to the effects of insulin. Unlike insulin, the glucose-lowering effect of FGF21 lasted for a full 24 hours after administration, as compared to only a few hours with insulin[6]. FGF21 transgenic mice had decreased levels of circulating triglycerides (TGs), cholesterol, and serum insulin, while experiencing extended lifespans and reduced body weights [6,9,10].

High doses of FGF21 did not induce hypoglycemia in any case, no matter whether mice were lean, diabetic, fasted, or fed [6]. Since then, these studies have been replicated in other rodents and nonhuman primates [11], and these newer studies have shown other pleiotropic effects such as increased total body insulin sensitivity [12], enhanced pancreatic islet β -cell function [13], reversed hepatosteatosis [14], and induced energy expenditure through brown adipose tissue activation [15]. Promisingly, when transgenic mice overexpressing FGF21 were fed high-fat diets and ate twice as much as their wildtype counterparts, they were resistant to diet-induced obesity [10,16]. Results of these preclinical trials are striking and have highlighted the potential that FGF21 and analogs have in treating obesity-related metabolic syndromes such as type two diabetes mellitus (T2DM), non-alcoholic fatty liver disease (NAFLD), and cardiovascular disease (CVD).

Development of a FGF21 molecule for clinical use was determined to be impractical, and thus the FGF21 analog LY2405319 (LY) was engineered to be used in further studies [17]. LY shares the same biological activity features of FGF21 and is identical in human and nonhuman models with respect to potency and efficacy [18]. The first clinical trial using LY was conducted by Gaich et al. (2013) and explored the effects of LY on obese human subjects (n = 46) with T2DM [19]. In this randomized, double-blind, placebo-controlled trial, subjects were given daily subcutaneous injections of LY (o-20 mg) for four weeks. At the end of the trial, the experimental group showed a significant decrease in serum TGs, total cholesterol, and low density lipoproteins (LDL), and an increase in high density lipoproteins (HDL).



Favorable effects on fasting insulin levels and body weight were detected [6,11,12]. Plasma adiponectin levels also increased in a dose-dependent manner. Adiponectin is a hormone released by adipose tissue and enhances insulin sensitivity through increased fatty acid oxidation and inhibition of hepatic glucose production. Low levels of adiponectin are highly correlated with increasing obesity, insulin insensitivity, and other metabolic syndromes [20]. Subsequent human trials have been conducted with various long-acting FGF21 analogs [21-23]. Another four-week trial using the FGF21 derivative PF-05231023,



Takdukdar et al. (2016), reported reduced body weight and increased adiponectin levels in obese monkeys and humans [23]. Charles et al. (2019) and Kim et al. (2017) did not observe weight loss in two other trials using the FGF21 variants BMS-986036 and PF-05231023 for obese, dyslipidemic patients with or without T2DM [21,22]. Variance in weight loss could indicate differences between studies in FGF21 derivative choice and dosing [24]. In contrast to the FGF21 animal model, there was no effect on fasting blood glucose in any of the human trials. However, all studies showed significantly reduced circulating TGs and increased HDL cholesterol [19,21-23].


Obesity contributes to over 300,000 deaths per year in the United States and is the second most common form of preventable death behind tobacco use [24]. In 2008, medical costs associated with obesity were estimated at approximately \$147 billion in the United States [25]. FGF21 has promising pharmacological and clinical significance for treating obesity-related metabolic disorder and should continue to be studied to combat obesity. Over the past 15 years, FGF21 and analogs have been shown to have dramatic effects on insulin sensitivity and lipid and energy metabolism in humans, nonhuman primates, and rodents. Clinical trials using FGF21 variants have all demonstrated beneficial effects on TG and HDL cholesterol levels. In the future, clinical trials using FGF21 and analogs should be replicated to validate or challenge the results of the studies discussed earlier. An essential focus in future research is establishing a uniform dosing pattern in order to adequately compare effects between FGF21 derivatives and to understand how to get the best physiological outcomes to promote wellness.

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Mental Health Mobile Apps: Full of Promise, But Approach with Caution By Audrey Tran '21



According to the National Alliance on Mental Illness (NAMI), one in every five adults in the United States had experienced some form of mental illness in 2018 [1]. However, in that same year, only 43.3% of US adults with mental illness received treatment [1]. Patients face innumerable barriers when seeking help for their mental health, including stigma, cost, uninsurance or underinsurance, and inaccessibility [2]. Furthermore, in certain regions of the US, particularly rural and southern areas, there is a severe shortage of mental health professionals [3].

Given this predicament, an array of mobile device apps purported to improve mental health and ameliorate mental illness have cropped up. These apps are typically free or low-cost in comparison to therapy sessions that cost \$100-200 on average [4]. Collectively, the apps aim to address a wide range of psychiatric disorders, including depression, anxiety, addiction, obsessive compulsive disorders, and eating disorders. They boast features such as mood trackers, inspirational

audio files and videos, lessons on mindfulness and mediation, and guided activities rooted in the principles of evidence-based psychotherapies like Cognitive Behavioral Therapy (CBT).

One such mobile app, MoodTools, is designed specifically to address clinical depression and is available for free download. The app's creators claim that it was developed in collaboration with several mental health professionals; however, names of reputable professionals or organizations are not listed in the product's official description on vending platforms. MoodTools users can complete the Patient Health Questionnaire-9 (PHQ-9) to determine the severity of their depression, record and analyze their thoughts in a thought diary to identify warped or negative thinking patterns, track their mood before and after performing an app-guided energizing activity, develop a safety plan in the event of suicidal thoughts or feelings, and watch TED talks and guided meditation videos.

Another app, MoodKit, does not focus on clinical depression or any other single mental illness, but rather is intended to improve general mental health. The app, which costs \$4.99, includes more than 200 mood-improvement activities that can be tailored to a user's particular needs, a thought checker through which users can identify and alter their negative patterns of thinking or reduce the intensity of negative feelings, a mood tracker to create and chart daily mood ratings, and a journal with custom templates for users to document their emotions in an organized fashion.

In a time when 81% of Americans own a smartphone [5], mental health apps have emerged as an appealing solution to a prominent national health issue. However, professionals from health and public policy sectors express concerns regarding the safety and efficacy of these apps. Because they are a relatively new development, there are limited regulatory frameworks in place to police the apps and keep them user-friendly [7]. The apps are being developed at an astonishing rate, with nearly 10,000 apps related to mental health now available, and more and more consumers downloading, using, and trusting in the apps. A study shows that a whopping 60% of people who own a smartphone have downloaded at least one mental health app [6]. Users frequently entrust the apps with confidential personal information, but this digital realm does not include the strict confidentiality rules surrounding patient-provider interactions, leaving consumers at risk for privacy and security breaches. A 2019 JAMA study found 29 out of a sample of 36 mental health apps transmitted data for advertising and marketing purposes or analytics to both Google and Facebook [8].

Furthermore, only 30.38% of the mental health apps available claim to have received any input from a mental health practitioner during development and only 20.48% of the apps are affiliated with any organization, university, government body, or medical center [6]. These statistics call into question how beneficial the apps could actually be when a majority of them appear to have been produced by people lacking crucial knowledge.

It's undeniable that there are potential benefits to the proliferation of mental health apps. Many of the barriers that people face in finding mental health treatment could be overcome by such low-cost digital options that can be easily downloaded and used in the privacy and comfort of a consumer's own home. However, more research must be done on the efficacy of the apps in improving consumers' mental health. Mental health clinicians should become more involved in the creation of the apps, and increased regulation for the apps' development, distribution, and use should be generated and enforced. Until then, people with mental illness should approach these apps with caution. Although mental health apps are potentially a valuable resource, they cannot yet be considered viable substitutes for in-person treatment from a licensed clinician.

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A Modern Approach to Diabetes Management, Treatment, and Prediction By Emily Grigg '21

Diabetes affects roughly 10.5% of the US population — in fact, it is the seventh leading cause of death in the US and in 2016, there were a total of 16 million emergency room visits by Americans with diabetes [1]. However, despite its prevalence, there is still a lot of misinformation surrounding this disease.

There are two main types of diabetes — type 1 and type 2. Type 1 diabetes occurs when the body does not produce insulin because the body's own immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas. On the other hand, type 2 diabetes occurs when the body still produces insulin, but the body's cells have become resistant to the action of insulin from years of high insulin levels. Thus, sugar builds up dangerously in the bloodstream. Although the causes of Type 2 diabetes are still unknown, lifestyle factors like diet and exercise are known to play a role [2].

Living with diabetes presents a wide scope of challenges. This includes the stress of constantly monitoring one's blood sugar, financial problems caused by the cost of treatment and medications, and medical complications such as chronic wounds, cardiovascular disease, coma, or even death [2]. However, there is still a cause for optimism, as innovative technologies have the potential to greatly alleviate these difficulties.



I. Ultrasound

Individuals with Type 2 diabetes often treat their condition with a drug or a combination of drugs that stimulate the pancreas to release insulin. While this is generally effective, it can also have negative unintended effects on other types of cells, such as those of the liver and kidney [3].One group of researchers is working to find a drug-free alternative: ultrasound. They have discovered that directing ultrasound waves at the pancreas can encourage the release of insulin. This is an exciting alternative because it accomplishes the goal of insulin release while avoiding the potentially liver-damaging side effects of current drugs [4]. However, this technology is still undergoing testing. If it advances past the necessary checkpoints, it can be harnessed to create an ultrasonic device that is used in tandem with a blood glucose monitor to release the appropriate amount of insulin.

II. Genetic Risk Study

Almost every newborn in the United States undergoes a genetic screening to check for diseases like phenylketonuria, sickle cell anemia, and hypothyroidism [5]. Researchers in Virginia are developing a test to be added to this panel that quantifies the probability of whether a child will develop Type 1 diabetes.

This test would help parents assess the kind of medical care they may need to seek for their child, while also helping them be aware of the subtle symptoms their child may present. Not every infant who will develop Type 1 diabetes will test positive and not everyone who tests positive will develop the disease, but it is still a step towards faster treatment. After all, many children with Type 1 diabetes are not diagnosed until they are hospitalized due to ketoacidosis, a severely dangerous result of high blood sugar that can lead to coma or death [6]. Diagnosing the disease before this occurs is imperative to keep these children safe and healthy, and this genetic test will help parents know if their child is at a higher risk, allowing them to be aware of the symptoms to look out for.

III. Smart Bandages

There are many complications of diabetes that go beyond blood sugar: cardiovascular disease, nerve damage, depression, and notably, chronic wounds. Chronic wounds are wounds that have not progressed in the normal timeline of healing and can result in infection and loss of function. Specifically, chronic wounds are the leading cause of non-traumatic limb amputation, which can be devastating [7]. One new technology that aims to combat this is the "smart bandage."



The smart bandage is a wearable device composed of miniature needles that can be controlled wirelessly. It allows for intradermal injections of medications that are minimally invasive and require less effort from the patient. Since different medications are required at different parts of the healing process, having these drugs administered wirelessly by a healthcare provider reduces the amount of error that could occur in this complex process.

Normal bandages need to be changed frequently and, in the case of diabetic chronic wounds, for extended periods of time. This opens up the individual to a greater risk of infection and other serious complications — issues that may be solved by the smart bandage. In a trial run of smart bandages on diabetic mice, not only was there a reduced risk of infection, but also a significant increase in complete healing and a decrease in scarring [8]. Thus, smart bandages have the potential to greatly improve the lives of diabetics.

While many of these ground-breaking technologies are still in the development stage and will not be available to the public for a significant period of time, it is still breathtaking to see the direction that the treatment of diabetes is heading. Every day, more and more research is published in this field, paving the way for more comfortable lives.

It is worth noting that none of these treatments can help people who need them if they cannot afford them. With the rising cost of insulin in the US, many diabetics are forced to ration their insulin because they simply cannot afford it. This is a deeply upsetting and dangerous practice. Therefore, it is important to consider that, while these new technologies are changing the face of medicine, they are useless if the people who need them the most have no way of accessing them.

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Privacy and Security Implications of Health Applications in Sub-Saharan Africa By Chinasa T. Okolo PhD '23



Mobile health (mHealth) is formally defined as "the provision of health services and information via mobile technologies" [1] and has been used to help diagnose infectious diseases, record patient information, and manage medication adherence. The use of mHealth is burgeoning in Sub-Saharan Africa and throughout the rest of the global south due to the prevalence of mobile devices in households and the low implementation cost associated with establishing digital frameworks for medical care. However, the current rush to innovate within this space combined with the range of established governmental policies in regards to mHealth applications in these countries could compromise the security of patients' personal health information. Current policy regulations regarding the use of electronic services and mobile applications for healthcare vary within countries across Sub-Saharan Africa, from established governmental policies in countries such as South Africa and Rwanda to strategic frameworks with no tangible policy implementation in countries like Nigeria, Lesotho, and South Sudan [2]. Without prioritizing these considerations, mHealth solutions meant to address the problems of infectious disease diagnosis, patient care management, and healthcare information accessibility in under-resourced regions could put these already vulnerable populations at further risk of harm.

Only 3% of all healthcare workers in the world are in Africa, even though Africans make up 17% of the global population [3, 4, 5]. The shortage of medical professionals and lack of access to basic healthcare faced by many people across the African continent contributes heavily to this disparity. The ubiquity of mobile phones and strong mobile network coverage across the African continent has led to a surge of mobile innovations, mostly in the areas of finance and e-commerce. Healthcare has seen a strong shift in mobile innovations as well. Insurers in countries such as Kenya allow patients to pay using mobile money services, and various companies throughout the continent have new applications for the remote diagnosis and treatment of common medical ailments [6, 7]. While the opportunity is ripe for mHealth initiatives to thrive in Sub-Saharan Africa, existing issues are exacerbated even further by the lack of security practices integrated by the researchers and developers of mHealth applications. Along with infrastructure hampering how securely mHealth applications can be deployed across low-resource regions, informed consent, privacy, and data security are other issues affecting mHealth. Beverly Townsend, a South African lawyer who specializes in digital health in Africa, addresses these concerns in her thesis, covering the legal and ethical challenges that mobile health poses in South Africa.

In her work, she finds that privacy and confidentiality of patient health information are covered by policies and legislation in conventional patient-doctor interactions, but is unclear when it comes to mediums such as telehealth and electronic health [8]. When researching mHealth interventions designed and implemented within Sub-Saharan Africa, privacy measures and potential security implications associated with their use are discussed non-comprehensively or not even at all. With these omissions, it is unknown how these methods are affecting their target populations and if the healthcare policies of the countries where the applications are being deployed are followed. As mHealth developments scale across the continent, strong security and privacy practices are critical in ensuring the safety of patent data. With many healthcare systems in the United States and across the world experiencing data breaches and theft of personal health information, these malicious attacks could target countries within Africa next [9]. To combat this, it will be important for stakeholders such as the World Health Organization, the African Medical and Research Foundation, the Global Alliance for Africa, academic research institutions, and academic researchers to collaborate with nationwide healthcare systems to create standards for the implementation of mHealth applications.

Sub-Saharan Africa will benefit most from the opportunities provided by mHealth if robust regulations are established in countries' national health systems. The current lack of robust policies in this domain have proven challenging when designing solutions for scale, weakening the environment for mHealth innovation in countries throughout the continent [10, 11]. Despite lacking policies, it is essential for researchers to begin developing mHealth applications with the best privacy and ethical decisions in mind. Small decisions such as authenticating sign-ins, verifying who has access to patient health information, or requiring data to be securely transferred through validated servers can make progress in addressing these issues. Just because there are no regulations to enforce the methods of mHealth researchers and app developers, the design process and subsequent implementation should not compromise the health and privacy of vulnerable patients. Governments should also be proactive in forming partnerships with researchers across various fields (medicine, sociology, computer science, human-computer interaction, etc.) who are working to improve healthcare in low-resource regions. This breadth of collaboration will not only ensure that these new policies surrounding mHealth are welldeveloped but that they also tackle issues associated with privacy, transparency, and ethics in this domain. Generally speaking, improving how ethical considerations are incorporated into the design and deployment of mHealth systems in low-resource regions will increase their effectiveness and protect the populations they intend to serve.

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The Case for Digital Enablement in Healthcare By Laura Yang MHA '21

The theory of disruptive innovation was introduced by Clayton Christensen in 1997 in his book, The Innovator's Dilemma. It describes how new markets displace incumbents and alter the way industries or markets function. The healthcare market is unique in that it lacks the existence of a disruptive business model. The issue with current innovations in healthcare is that the newly implemented technology often helps hospitals and doctors solve the most complex solutions, but does nothing to increase the accessibility and affordability of healthcare to patients [1]. Technology enablement looks at getting organizations to use technology and information at the top of their scope in order to enhance the analytics, operations, and delivery of healthcare. A question posed by Becker's Hospital Review is: "Does IT need to be disruptive to bring meaningful improvement to the healthcare industry?" [2]. Enabling healthcare informatics has a two-fold impact, affecting both the clinical side and the administrative side.

On both sides, healthcare informatics facilitates a more streamlined patient experience. For example, NextGen Healthcare delivers an integrated solutions system that "supports patient engagement with patient portal solutions, online scheduling, virtual visits, secure messaging, and personalized outreach capabilities" [3]. Statistics show that 68% of patients prefer scheduling appointments and requesting refills online and that physician engagement with patients increases by 60% through online applications and portals.

Management consulting firms are helping healthcare organizations to strategically transform their operations through healthcare analytics. Digital analytics allow healthcare organizations to assess healthcare cost, quality, and access "by supporting consumers and providers with digital tools as they make care decisions and manage their chronic conditions" [4].

It is exciting to learn about the wealth of technology being implemented within healthcare such as "artificial intelligence (AI), robotics, precision medicine, 3-D printing, augmented reality/virtual reality, genomics, telemedicine, and more" [5]. As healthcare delivery moves from fee-for-service and in-patient care to value-based and out-patient care, individuals working in the healthcare sphere must be aware of this shift to decentralized and patient-centered care. Smart hospitals employ a high-level of automation across their work streams and compare patient care through the life-cycle of care provision.



Overall, it is integral to keep in mind that the healthcare landscape is changing for the better. While it may be a slow move towards the end goal of a fully integrated patient healthcare system, we can all be more aware of the changes that are occurring and embrace the power of healthcare informatics.

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The New Age of Information Technology By Rushil Shah '22



Weeks of uncertainty, recovery, and compromised immunity are likely to follow any medical procedure. This uncertainty revolving around a patient's health status often results in intense apprehension for loved ones. In order to ease the anxiety, many companies such as Google and Intel are developing predictive analytics tools. The technology focuses on using electronic health records (EHRs) to form accurate predictions regarding the length of a hospital stay, the likelihood of hospital readmissions, and clinical outcomes for each patient [1].

Traditionally, when analyzing EHRs in the healthcare sector, analysts focused on minimizing extraneous health information before making predictions about health behavior. This process helped providers stay up to date with patients' health for appointments, but did make insights into patients' health outcomes. If information technology systems were used to predict outcomes they were highly inefficient, as data processing took a long time. This data processing limited the information in the technology by eliminating free-text notes or documents that were not typically relevant in a patient's history. An unforeseen consequence of this model was highlighted in more complex settings — in hospitals, providers use thousands of free-text notes that contain the bulk of patient health information and cannot be discarded in analysis. Taking these challenges into consideration, Google currently seeks to reapproach modeling in the healthcare sector by developing artificial intelligence (AI) systems with predictive capacity [1].

With previous difficulties in mind, Google's current focus includes AI systems that employ deep learning as a method for tackling the challenges posed by the high volume of extraneous information from EHRs. Deep learning is a subset of machine learning whereby a machine can develop solutions to complicated problems without formal paradigms for problems. The deep learning approach, aided by advancements in speech recognition, natural language processing, and sequence prediction, is effective at identifying key variables and sifting through extraneous information. Improvements in accuracy likely result from the unique deep learning approach, which identifies key aspects of the patient's medical history [1]. For instance, when analyzing health predictions for a woman diagnosed with late-stage breast cancer, the system sorted through 175,369 data points and assigned a significantly higher risk of mortality than her provider's assigned risk. The woman passed away ten days later. This example highlights the effectiveness of the model and the inaccuracy of existing methods, even if the model was not able to save her [2]. Thus, the model is valuable for hospital administrators and patients alike to quantify the risks associated with a procedure and to reallocate resources so that patients' specific needs can be addressed.

Advancements in this field are not only transforming the current conditions for patients, but also pioneering new developments for rare and complicated disorders. Google Cloud recently partnered with the Mayo Clinic, one of the leading hospitals in the United States, with aims to use AI systems to not only streamline the process of disease diagnosis and treatment but also advance clinical research conducted at the hospital. The Mayo Clinic is hopeful that this partnership can assist in identifying key indicators associated with rare and complicated disorders by using an innovative digital approach to diagnosis and treatment [3]. This shift has assisted in significantly decreasing the processing time associated with medical imaging from 16 hours to one hour, ultimately improving the speed and quality of care for patients [4].

Intel, in conjunction with the Perelman School of Medicine at the University of Pennsylvania, has adopted a similar data-driven approach to patient care. Intel's model focuses on identifying key performance indicators (KPIs) highly associated with certain diseases as well as informing clinicians of potential risks. From this collaboration emerged Penn Signals, a platform for communication between clinicians to help reduce the costs of sepsis and heart failure in several hospitals. Whereas traditional methods were effective in identifying 50% of sepsis cases, the new Penn Medicine algorithms raised effectiveness to 85%. Furthermore, the new technology correctly diagnosed 20-30% of heart failure cases that were previously misidentified. Ultimately, this approach improved patient care and lowered the readmission rate for patients in the associated hospitals [5]. Although Intel's collaboration is only one successful case of the use of predictive information technology, the possibilities for unique applications are endless.

The healthcare sector is filled with complex issues that can feed inefficiencies and misdiagnoses. Predictive information technology represents a unique approach to combat these issues by combining detail-oriented analyses of patient histories with clear communication between professionals. Expanding this innovative approach is essential for improving the quality and efficiency of healthcare in the US.

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Smart Hospitals: A Smart Decision? By Cathy Shi '22



"Alexa, set house temperature to 70 degrees."

"Alexa, set the volume to 5."

"Alexa, call the hospital."

We already use smart devices like Amazon's Alexa for many different purposes in our everyday lives. Smart phones, smart watches, and smart TVs are just a few more examples of how smart technology has already become deeply integrated into our lives.

Hospitals have also begun introducing smart technologies to their rooms. These "smart hospitals" utilize modern technologies to deliver care and resources to a patient during their hospitalization. These technologies have the ability to change perceptions of healthcare and improve the quality of care, but at what monetary and human cost? Amidst the smart devices already present in our everyday lives, are smart hospitals a worthy addition?

Cedars-Sinai Medical Center in Los Angeles, California became one of the first smart hospitals in 2017 when it introduced several novel programs. Aiva is one such program — it utilizes an Alexapowered platform, which allows patients to control their own entertainment and interact electronically with nurses [1]. Instead of waiting for a nurse to go to them, patients can use the tablets next to their hospital beds to notify nurses of their every need. Peachy Hain, the executive director of Medical and Surgical Devices at Cedars-Sinai and director of the pilot program, claims that these familiar devices "enhance the hospital experience" since patients are already accustomed to voice-activated smart devices in their own homes [1]. Moreover, a nurse at Cedars-Sinai believes that Aiva allows nurses to focus on more important tasks instead of menial work such as changing TV channels [1]. In addition, Cedars–Sinai is incorporating the MyChart Bedside iPad app, which allows patients to electronically contact their healthcare providers. More than 250 iPads have been brought to the medical center to allow hospitalized patients to check their medical records and lab results and familiarize themselves with their care team [1]. Tom Foley, the director of Worldwide Health Solutions strategy for Lenovo Health, has even suggested having patients bring hospital tablets home after treatment so that patients can monitor their postoperative condition, read about post-treatment guidelines, and ask their care team follow–up questions [2]. In such ways, smart technology could become the medium that links care inside and outside of the hospital.

In 2010, IBM and the University of Pittsburgh Medical Center (UPMC) introduced the SmartRoom, a technology that can "improve the safety, quality and efficiency of health care" [3]. IBM claimed that the SmartRoom solution would make doctors' and administrators' jobs easier and give nurses more quality bedside time with patients, exactly what professionals are now saying about Aiva [3]. Like Aiva, SmartRooms allow patients to notify healthcare professionals of their needs, and if the request is not followed through in a timely fashion, the notification is pushed up the chain of command. However, the funding for IBM's SmartRoom solution came from UPMC and IBM's \$50 million co-development fund, created in 2005 as part of an eight-year agreement to redesign UPMC's information technology infrastructure and commercialize clinical solutions for other healthcare providers [3]. Unfortunately, the fund was only enough to build 24 SmartRooms in UPMC Montefiore, meaning that, on average, each room cost more than \$2 million.

Not everybody is convinced that smart hospitals will be able to revolutionize healthcare. Today, few hospitals have smart technology due to a lack of investment capital supporting this kind of innovation, which is evidently very costly [4]. Turning standard rooms into smart rooms requires a team of experts who work closely for months to years. In a rapidly changing technological landscape, many hospital executives are reluctant to invest millions of dollars into technology that could easily become outdated within the span of a few years. In addition, doctors and nurses can find themselves bombarded with notifications from patients, which can distract them from more urgent tasks. For example, over-sensitive motion detectors, designed to alert nurses when feeble patients fall out of bed, can trigger false alarms [4]. According to Paul Butler, a director at Top Tier Consulting who helped construct Los Angeles' Martin Luther King Jr. Medical Center's smart hospital rooms, doctors and nurses often lose patience trying to troubleshoot issues if the new technology is not 100% reliable [4].



Another issue is how the elderly fare in an increasingly technological hospital setting. The elderly visit doctors more often and more frequently spend time in the hospital due to age-related conditions like heart attacks, strokes, and fractures. Medicare, the federal health insurance program that primarily serves elderly (over 65) patients, accounts for 15% of total federal spending in the United States [5]. One reason that Medicare spending is so high because the elderly utilize the healthcare system at higher rates and rack up higher bills. New technology will indubitably drive up costs in these high-utilization age groups, but will these costs actually serve elderly patients well? It is worth wondering whether many of the elderly, who are often less familiar with technology than younger generations, would be interested in or capable of using an iPad during their stay.



This could also have negative implications for physicians, who may experience burnout from increasing amounts of responsibilities apart from providing traditional medical care. In addition to medical procedures that doctors have to perform, they may also have to begin teaching the elderly how to use technology. Over half of all physicians in the US experience physician burnout at some point in their career, which is "a combination of exhaustion, cynicism, and perceived inefficacy resulting from long-term job stress" [6]. Physicians are tasked with a growing amount of administrative work due to the complex insurance system in the US, which prevents them from spending quality time actually treating patients and takes much of the human interaction out of their jobs [6]. Adding complex technology to doctors' plates may contribute to physician burnout and frustration.

Implementing smart hospitals across the nation will raise a number of questions. For example, who will finance the construction of these smart hospital rooms? If we see increases in health insurance premiums, rising numbers of uninsured patients, and overall rising national health expenditures after they are built, who will be able to afford to stay in them? Despite the extra expenditures, upgrading to smart hospital rooms may not lead to significant improvements in the quality of care. Even a study examining the efficacy of the Smart Bedside Station (SBS) hospital system found that although personalized bedside terminals are applicable in inpatient hospital settings, further research needs to be conducted to assess how they can be used to improve physician-patient communication [7]. Without conclusive data from pilot programs at places like Cedars-Sinai and UPMC Montefiore, it remains difficult to decide whether smart hospitals are a viable way to revolutionize hospitals.

It is crucial to be farsighted when dealing with medical technology advances because of their impacts on human lives. We must consider the hidden costs, such as the time and energy needed for physicians and nurses to learn how to use the technology. The United States' national health expenditure was about \$3.6 trillion in 2018, which accounted for 17.7% of GDP [8]. 27.9 million nonelderly adults were uninsured in 2018, which was a 500,000-person increase from the uninsured rate in 2017 [9]. With these numbers in mind, we should be focusing on access issues in the U.S. healthcare system instead of embarking on multi-million dollar projects that may or may not improve patient health outcomes and satisfaction.

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