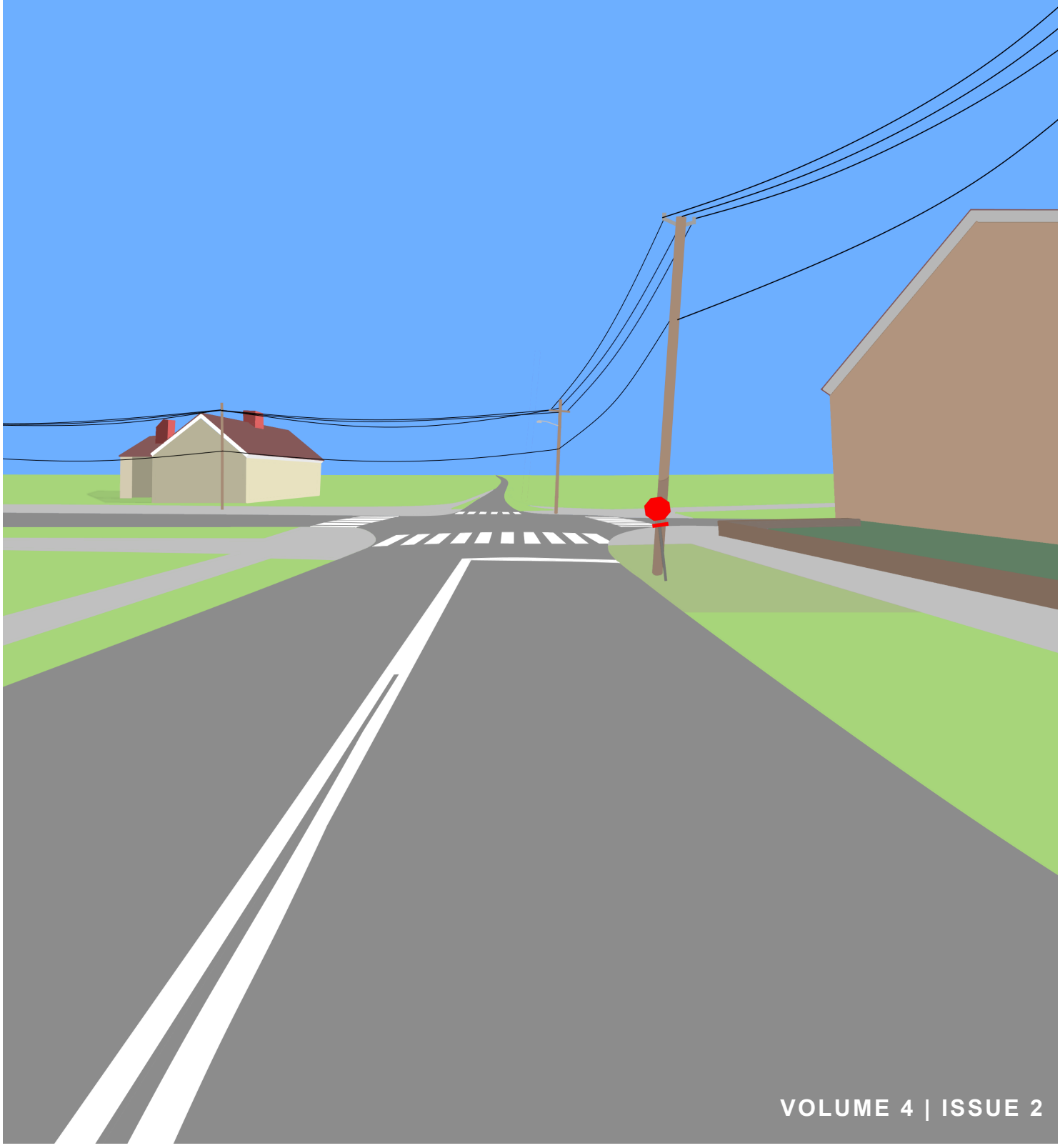
November 24, 2020

CHOATE PUBLIC HEALTH



VOLUME 4 | ISSUE 2

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FINDING A PRODUCTIVE BRAIN SPACE

By Juliet Ainsley '22

Graphic by Elton Zheng '22

The search for a comfortable, productive study space can prove challenging for remote and in-person students alike. Nonetheless, study spaces are influential on a student's productivity. According to the results from a study that monitored the effects of the environment on 3,766 primary school students, the seven key components of the environment — light, temperature, air quality, ownership, flexibility, complexity, and color — resulted in up to 16% variation in study productivity.[1]

These components vary from person to person: some students may like to study in complete silence, for example, while others prefer a place with background noise. Of course, understanding these components and personal preference is crucial when finding a productive study space.

When considering the lighting in a study environment, psychologists encourage students to use uniform or natural light that is not too dim or too harsh.[2] Furthermore, wherever students may be, psychologists agree that consistency is key and encourage students to create a habit to study in the same space. A designated study location leads to consistent changes in one's physical function that can enhance productivity, such as heart rate, breathing, emotion, and cognition.[3]

Another important factor in finding a study space is to minimize distractions. Students can do this by turning off their phone or leaving it in another room. Incorporating rewarding breaks between study times, such as calling a friend, has also proven to be effective in enhancing a student's productivity.[4] While physical study spaces vary among students, finding a place that improves productivity is essential for student success.

Sources

1. Barrett P, Davies F, Zhang Y, Barrett L. The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment*. 2015 Jul; 89: 118-133.

2. Zipkin N. For a more productive office, appeal to the five senses. *Entrepreneur*. Published October 25, 2014.

3. Kline S. Understanding Environmental psychology helps students with productivity. *The Prospector*. Published December 23, 2019.

4. How your study environment affects productivity (and how you can improve it). Realtor University. Published April 7, 2015.

AT HOME DNA-TESTING: WHAT ARE THE FLAWS?

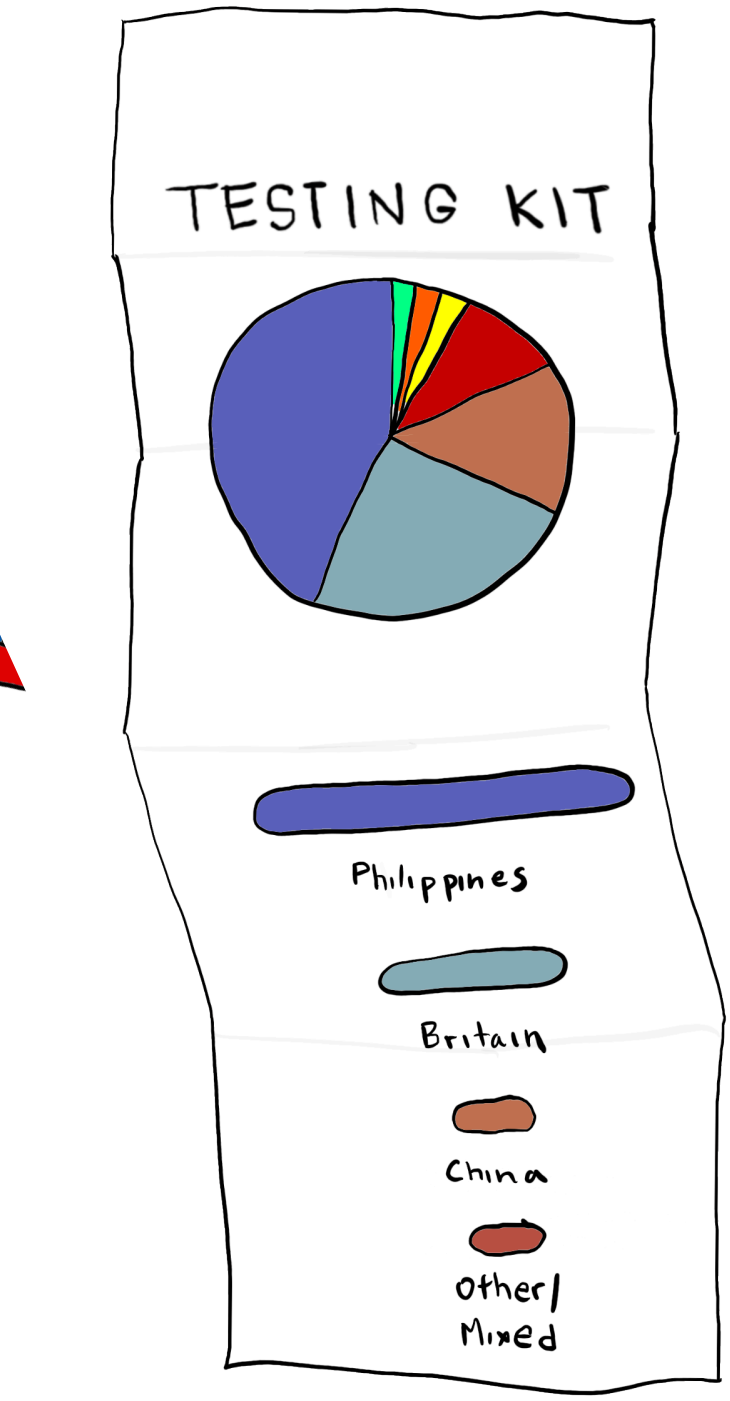
By Ellie Pyper '22

Many people, in learning about their families, are curious to know where their ancestors are from. Others may sit questioningly before a health form, unsure which members of their family might have had some pre-existing condition. These questions can usually be answered by simply asking parents or grandparents, but their memories and stories can only provide so much information. That's where direct-to-consumer (DTC) at-home DNA testing comes in handy, offering answers to these and many more questions through a simple test. The most common examples of these at-home DNA testing kits are AncestryDNA and 23andMe. These tests have over 5 million users in their database collectively.[1]

To complete the DNA test, a person can send a stool sample, get their blood drawn, spit into a vial, or swab their cheek and mail in their sample — all from the comfort of their own home. On average, a genetic health profile, including genetic background and the risk level of acquiring certain diseases, is returned to the consumer within a month.[2]

There are three main reasons people seek at-home DNA tests: to learn about one's identity, test disease risk, and pursue a better lifestyle. Identity-seeking tests include discovering a person's heritage or serving as a paternity test. To gather information, they usually test a person's mitochondrial DNA, Y chromosome, and markers on the autosome. Disease risk testing is directed at specific genes and their corresponding diseases, such as the genes BRCA1 or BRCA2, which are involved in hereditary ovarian cancer. Finally, the desire for a better lifestyle is the most prevalent reason one may seek at-home DNA testing. These types of tests usually offer information on more common diseases; traits measured can be as basic as underarm odor or earwax.[3]

While these tests may seem like a simple way for a person to make important medical and lifestyle decisions, they raise a multitude of ethical and accuracy concerns. Many of these companies are gaining much more information from the customer than the customer is from the tests. There is a major conflict of interest for companies because they can gather, use, and sell information provided by the customer through their tests. 23andMe states on its website that it "could keep their physical spit sample and the genetic data it contains for up to a decade" if a person opts to share their data for research.[4] This could result in major breaches of privacy, and even worse, the companies are not required to disclose what they use their customers' data for.



Graphics by Elton Zheng '22

Furthermore, these companies will often align themselves with pharmaceutical companies and other private and public research organizations. However, once this information has been collected by these outside research organizations, the original at-home DNA testing companies are no longer responsible for the security protocol they had promised their customers.[4]

Accuracy is often also in question when one decides whether to send in their sample to be analyzed. A recent study conducted found that "40 percent of variants associated with specific diseases from 'direct to consumer' (DTC) genetic tests were shown to be false positives."[1] This is shocking considering that the only purpose of these tests is to provide information based on a person's DNA, and false positives can easily cause undue concern and even spread panic if a person received a false-positive for a more serious disease.

Another accuracy concern comes with faulty interpretation. Genome-Wide Association Studies often interpret the DNA of interest for these tests; however, many complex traits have dozens of variants, and they only offer a probability of disposition towards a certain behavior. An example of this would be individuals carrying a version of a gene that increases their probability of developing Alzheimer's, but many with this variant do not ever end up developing the disease. These diseases can also largely be determined by outside influences such as lifestyle. It all comes down to the idea that genetics is a probabilistic science, and no genes are guaranteed to represent any certain thing.[1]

Overall, as at-home DNA testing continues to ramp up in popularity, one should be wary of where one's DNA is going and the accuracy of the results. In many cases, the information received may not be accurate, while the information sent is not fully protected.

Sources

1. Rutherford A. How Accurate Are Online DNA Tests? *Scientific American.* Published October 15, 2018.

2. Hatfield H. Home DNA Tests: Buyer Beware. WebMD.

3. Su P. Direct-to-Consumer Genetic Testing: A Comprehensive View. National Center for Biotechnology Information. Published September 20, 2013.

4. Ethical Use of Home DNA Testing. Ethics Unwrapped.

OPERATION WA
THE DANGERS C
COVID-19 VACC

By Mealy C

To date, scientists across the world are developing potential vaccines to prevent SARS-CoV-2. There are currently more than a hundred projects aiming to develop a vaccine, with eight candidates now in the clinical trial stage. Promises of developing a workable vaccine by the end of the year abound in many countries, but accelerated timelines raise skepticism among not only the anti-vaccination population but also among supporters as well.

This September, the Pew Research Center poll noted that intent to vaccinate fell 72% since a similar poll from May of this year.[1] Similarly, a recent *USA Today* poll demonstrated that two-thirds of Americans, distrustful of the Trump administration's rush to develop a vaccine, would not get vaccinated.[2] Reasons for their reluctance included concern over the vaccine's safety and effectiveness due to an abridged approval process, uncertainty over potential side effects, and overall cost.

Not surprisingly, those against vaccinations, dubbed "anti-vaxxers," are using the rush-to-market approach to support their beliefs. The anti-vaxxer movement gained traction in the 80s and 90s with the 1982 documentary *DPT: Vaccine Roulette* and British gastroenterologist Andrew Wakefield's publication in 1998 that linked the measles, mumps, and rubella vaccine with autism. Although the scientific community has disproved these works, celebrities and conspiracy theory groups have recently been propagating misinformation to the public using such misguided studies as evidence.

Yet, even among vaccine supporters, there is an escalating sense of unease over the fast-tracked COVID-19 vaccine. With 12.1 million cases and over 250,000 deaths in the country, the U.S. has prioritized developing an effective vaccine.[3] Typically, the process of developing a safe and effective vaccine takes around a decade; however, the Trump Administration anticipates one readily available for COVID-19 by the end of this year, compressing an extensive testing process from 10-plus years to less than one. Health officials have been outwardly casting doubt on this accelerated timeline of vaccine development, making the pro-vaccination populace nervous.

Scientists warn that the public's increasing reluctance to vaccinate might lead to a prolonged pandemic, keeping the U.S. from developing herd immunity. Researchers at the Johns Hopkins Center for Health Security and the Texas State University Anthropology Department said, "If poorly designed and executed, a COVID-19 vaccination campaign in the U.S. could undermine the increasingly tenuous belief in vaccines."[4]

President Trump initiated Operation Warp-Speed to quickly roll out a safe and effective

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Graphics by Yuko Tanaka '22

Cronin '23

COVID-19 vaccine. The project costs almost $10 billion, but researchers note that little of the funding is being used to investigate the hesitations accompanying the fast-tracked vaccine.[5]

Some critics might suggest that President Trump adopted this program to boost his approval ratings before the presidential election. In early September, the Centers for Disease Control and Prevention (CDC) advised hospitals to be prepared to distribute a vaccine by November 1, only two days from Election Day. In late July, the President boasted that the Operation would provide a vaccine in record time, explicitly stating that his re-election was tied to the administration of an effective vaccine.

But not everyone agrees with President Trump's assessment of the timeline. Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases, countered that he was "cautiously optimistic that we will have a vaccine by the end of this year and as we go into 2021."[5]

Sandra Crouse Quinn, a professor of Public Health at the University of Maryland, offered, "If you're smart, you're worried we won't have a vaccine, and if you're smart, you're worried that maybe we've moved so fast that we'll accept a level of risk that we might not ordinarily accept."[6]

If a vaccine is rushed to market before deemed effective and safe by the scientific community merely to fulfill the President's political agenda, anti-vaxxers and pro-vaccinators should be worried. If this vaccine fails, we may well have to contend with yet another pandemic: one with a consequence far greater than COVID-19 — the public's ultimate distrust of all vaccines.

Sources

1. Tyson A, Johnson C, Funk C. U.S. Public Now Divided Over Whether To Get COVID-19 Vaccine. Pew Research Center. Published September 17, 2020.

2. Elbeshbishi S, King L. Exclusive: Two-thirds of Americans say they won't get COVID-19 vaccine when it's first available, USA Today/Suffolk Poll shows. *USA Today*. Published September 4, 2020. Updated September 7, 2020.

3. United States COVID-19 Cases and Deaths by State. Centers for Disease Control and Prevention.

4. Hoffman J. Mistrust of a Coronavirus Vaccine Could Imperil Widespread Immunity. *The New York Times*. Published July 18, 2020. Updated September 1, 2020.

5. Coronavirus: Operation Warp Speed. U.S. Department of Defense.

6. Mozes A. Fauci 'Cautiously Optimistic' for COVID-19 Vaccine by Year's End. U.S. News & World Report. Published October 21, 2020.

AMERICAN HEALTHCARE IS FAILING ITS POC MOTHERS

By Nathaniel Rogers '23

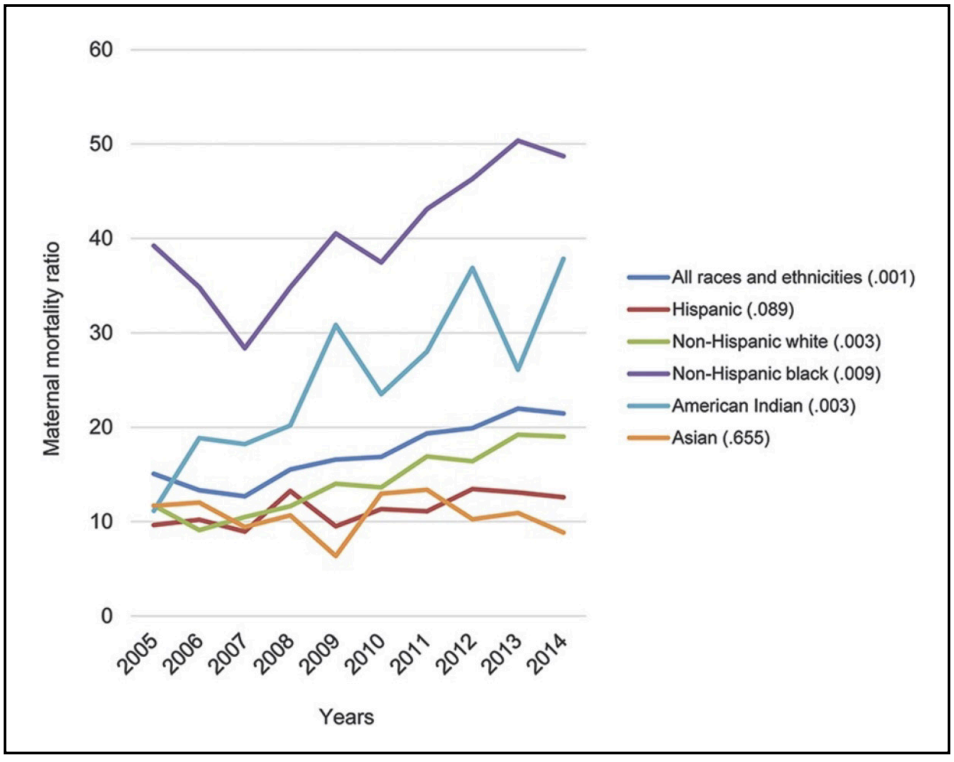
Many Americans believe that the United States is a global leader in all aspects of science and health. However, when it comes to maternal health, the U.S. is ranked below most other developed countries, despite spending the most on hospital-based maternal care in the world. The maternal health crisis in America is getting worse, and not all races and ethnicities are equally affected.

The American mortality rate is about 17 deaths per 100,000 live births. However, when broken down by race, we can see that this mortality rate is far higher for people of color, especially Black people, than it is for white people. According to the same source, the mortality rate for white women is 13 deaths per 100,000 live births, for Native American women, the rate is roughly double that, while Black women see a rate of 41 deaths per 100,000 live births.[1]

Another especially clear figure comes from Washington, D.C.: across the states and territories, D.C. has the worst mortality rate in the nation. At the same time, though, it has the lowest mortality rate for non-Hispanic white women.[2] Clearly, the level of maternal healthcare that the white women of D.C. are given is different than that of people of color.

Death during pregnancy isn't the only instance of racial disparity in maternal health; maternal comorbidity — the presence of multiple chronic conditions in a mother — rates are also on the rise in the U.S., and, again, that increase is not uniform across races. From 1993 to 2012, the comorbidity rates among expecting mothers increased by 4.3% overall. Specifically, there was a 5.6% increase for white women and a 9.9% increase for Black women.[3]

Clearly, the maternal health crisis in America isn't affecting everyone equally. How can we keep America's moms as healthy as they can be?



Source: Obstet Gynecol 2016

Sources

1. Maternal Health in the United States. Maternal Health Task Force. Published 2015.

2. Moaddab A et al. Health Care Disparity and State-Specific Pregnancy-Related Mortality in the United States, 2005–2014. *Obstetrics and Gynecology.* 2016; 128(4): 869-875.

3. Metcalfe A, Wick J, Ronksley P. Racial disparities in comorbidity and severe maternal morbidity/mortality in the United States: an analysis of temporal trends. *Obstetrics and Gynecology.* 2017; 97(1).

A MENTAL HEALTH CRISIS FOR HEALTHCARE WORKERS

By Chloe Chan '23

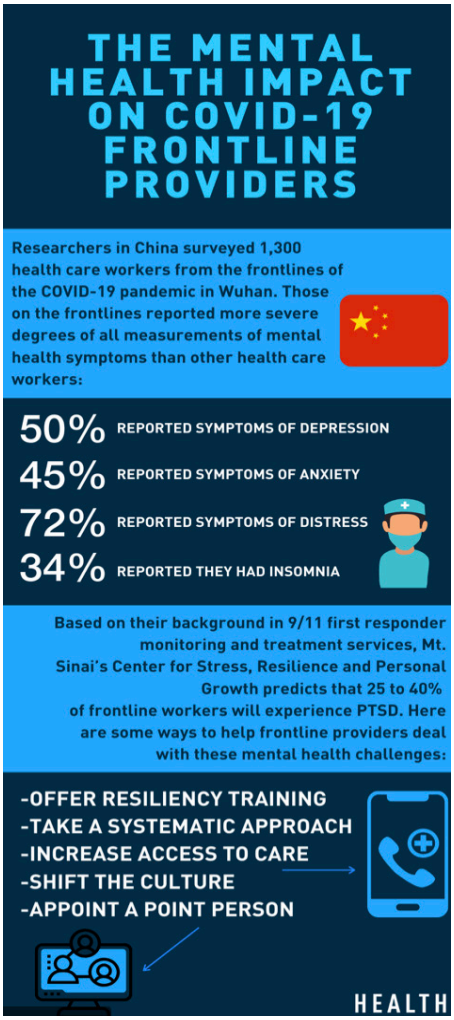
When people think of healthcare heroes amidst the still-intensifying COVID-19 pandemic, they might imagine people bustling about in physically demanding, fast-paced work days. However, the public often neglects to consider the mental burden placed on these healthcare professionals.

Healthcare workers face enormous amounts of pressure in their day-to-day lives. In addition to working long and taxing hours, they must deal with holding responsibility for the lives of their ill and injured patients.[1]

The ongoing crisis with the coronavirus adds even more to their already overflowing plates. First, healthcare workers on the front lines face an increased risk of being exposed to the virus. Additionally, there currently is a shortage of medical equipment; healthcare workers must work with a lack of protective equipment and manage the allocation of a decreasing amount of resources to an increasing number of patients in need.[2]

These chronic stressors can cause serious anxiety, which can take many behavioral or physical manifestations, such as sleep problems or headaches.[1] In the long term, healthcare workers who face daily stress often experience burnout, diagnosis and treatment errors, as well as absenteeism in the workplace.[1]

However, these mental challenges often go unattended due to the stigma of mental health in the industry. Medical professionals are expected to be healthy — both physically and mentally. Since mental health issues could negatively impact the quality of care, healthcare workers are dissuaded from disclosing these issues and thus inhibited from seeking proper treatment.[3] To remedy this issue, many institutions such as University of Michigan's academic health center have launched mental health support programs.[2] While hospitals and healthcare workers are working to gradually wear away the stigma of seeking help, one way we can all help them is to abide by healthcare guidelines to prevent the spread of COVID-19.



Source: Health Evolution

Sources

1. Exposure to Stress, Occupational Hazards In Hospitals. Centers for Disease Control and Prevention.

2. Gavin K. This Spring They Were Heroes, But This Summer May Be Cruel For Health Professionals. M Health Lab. Published June 22, 2020.

3. Knaak S, Mantler E, Szeto A. Mental Illness Related Stigma In Healthcare. *Sage Journals.* 2017; 30(2): 111–116.

CRYOSLEEP: WHERE SC

By Sofia M

The notion of cryosleep has long been depicted in popular science fiction films and literature ranging from *Interstellar* to *Avatar*.[1] Futuristic ideas have always been around — think flying cars and alien invasions — but they have been accompanied by doubt of their feasibility. Despite that, cryosleep might be happening sooner than you think.

Cryosleep, also called cryogenic sleep or suspended animation, is a deep sleep at very low temperatures.[2] The purpose of this "deep sleep" is to use the cold temperature to allow human vital functions to stay intact while the rest of the body goes into a semi-permanent state of hibernation. Cryosleep may not be readily available for the public in the near future, but it is already being developed for usage in the aeronautic, food, and health industries.

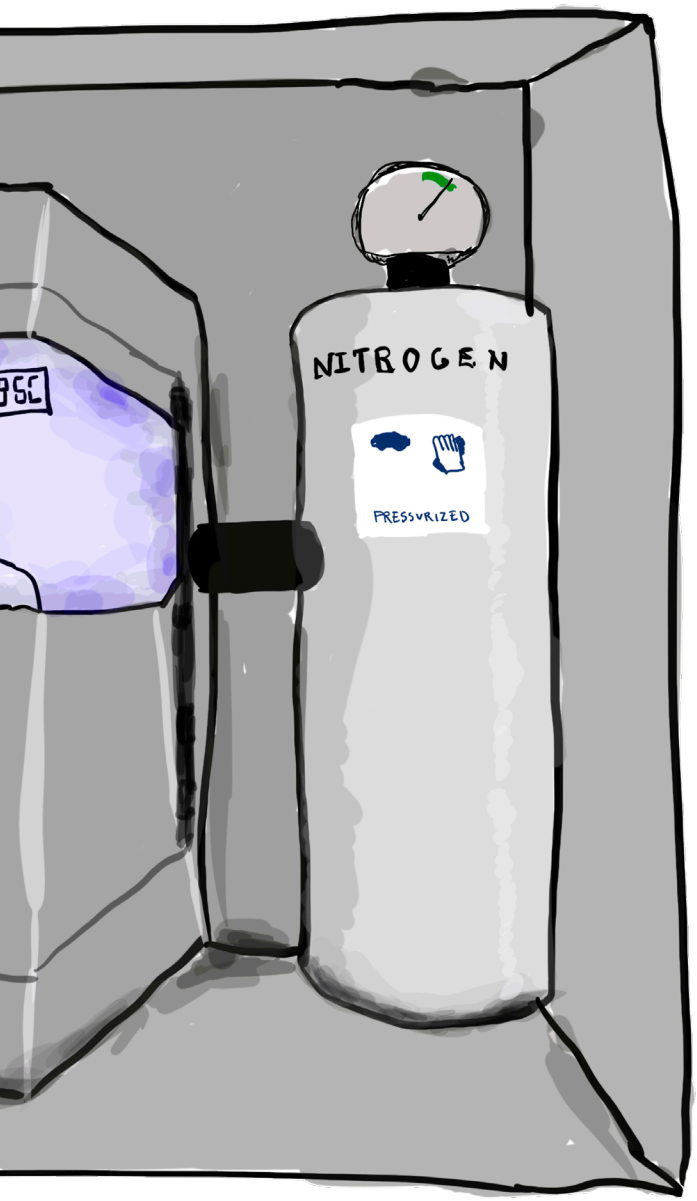
Many humans, animals, and other life forms have been found perfectly preserved after being frozen in ice. In 1967, Dr. James Bedford was the first person to be cryopreserved. Though Dr. Bedford died of kidney cancer, he was hopeful that doctors in the future would be able to bring him back to life if he was preserved in a cryo-chamber.[2] He now remains at the Alcor Life Extension Foundation, maintained in liquid nitrogen. It is yet to be determined if he can be brought back to life with current technology. According to Biotecknia, a biotech website, there are approximately 300 cryogenically frozen individuals in the United States alone, with more individuals in other parts of the world.[2]

Graphic by Elton Zheng '22

The biggest hope for cryosleep as of late is The National Space and Aeronautics Administration's (NASA) new project called the "Torpor Inducing Transfer Habitat for Human Stasis."[2] NASA is working alongside SpaceWorks Enterprises to develop a device similar to a stasis chamber, "a device used to preserve life."[4] The aim of this project is to create a space pod that will preserve astronauts in a deep-sleep by utilizing a cryo-chamber. By enabling deep-sleep, the astronauts will be able to stay aboard a spacecraft for a prolonged period of time to travel to other planets light-years

CIENCE MEETS FICTION

Muñoz '23



away. Without cryosleep, aging would act as a major constraint to reaching distant planets.

Dr. John A. Bradford, a leader at SpaceWorks Enterprises, originally proposed the method that was developed in 2014. At the 2016 International Astronautical Congress, Dr. Bradford said, "Following up on our IAC 2015 presentation showcasing the capabilities of our technology towards enabling transport of 100 colonists to Mars, we are pleased to be continuing this important research and breakthrough capability with support from NASA."[5]

One problem with the concept of cryosleep is that even scientists are unsure about what an animal goes through while hibernating, or this deep sleep at very low temperatures.[5] Even so, scientists have made progress on research about hibernation. A study conducted in 2011 by *The Journal of Neuroscience* showed that the brain's A1 adenosine receptor — which regulates sleep — is important in helping animals hibernate. Scientists have recently had an enormous breakthrough with the A1 adenosine receptor, and they are now able to act on the receptor to induce an animal into a state of hibernation.[5] Dr. Branford also noted the impact of the hibernation: "If you were to dedicate your time into any one particular part of a Mars and human exploration project, this technology would demonstrably have the most significant impact to the mission."[5]

If SpaceWorks Enterprise and NASA's experiments with cryosleep prove to be worthwhile and safe for humans to use, we could be seeing a world where cryosleep is routine for all types of space missions and perhaps even here on Earth.

Sources

1. Suspended Animation in Fiction. Wikipedia. Published March 25, 2020.

2. Porter L. Will Cryogenic Sleep Ever Be A Thing? The Sleep Matters Club. Published January 14, 2020.

3. Rayne E. NASA Is Bringing Cryosleep Chambers out of Fiction and into Science. Syfy Wire. Published May 23, 2018.

4. Stasis Chamber. Memory Alpha.

5. Koebler J. A Brief History of Cryosleep. *Vice.* Published January 19, 2016.

TRIGGER WARNINGS: MORE HARM THAN GOOD?

By Blake Bertero '22

Trigger warnings have swept the nation as a way to preface disturbing or explicit content in academic courses, social media, and television, but are they effective? The short answer is: sometimes. Trigger warnings first became popular as a solution to the retraumatizing effect of the increased representation of traumatic experiences, such as eating disorders, sexual assault, or post traumatic stress disorder (PTSD), in the media. However, multiple studies have shown that participants had the same levels of negative reaction whether or not trigger warnings were shown, and in fact, the warnings led to stress levels increasing in the period before viewing said content.[1] Moreover, the number of participants who chose to opt into viewing the content post-disclaimer was inconsequential. While this evidence discredits the overall effectiveness of trigger warnings, they can still offer opportunities for people with PTSD to avoid content that could potentially provoke feelings of anxiety or panic.[2] About half of all professors in the United States include trigger warnings in their course materials as signs of controversial content that can be approached with open discussion.[3] Researchers have also argued that adding trigger warnings prepares people to react realistically to troubling content and re-sensitizes viewers to trauma and danger, ultimately making them more cautious and responsible. Therefore, trigger warnings work both ways.[4] Although they are not as effective as one might hope for, trigger warnings can still provide protection for sensitive audiences, and should thus continue to exist in the media.[5]

Graphic by Sesame Gaetsaloe '21

Sources

1. Flaherty C. Death Knell for Trigger Warnings? Inside Higher Ed. Published March 21, 2019.

2. Trigger Warnings Do Little to Reduce People's Distress, Research Shows. Association for Psychological Science. Published March 19, 2019.

3. Khazan O. The Real Problem With Trigger Warnings. *The Atlantic*. Published March 28, 2019.

4. Fagan A. Do Trigger Warnings Actually Work? *Psychology Today*. Published April 17, 2019.

5. Guide to Trigger Warnings. Oxford University Student Union.

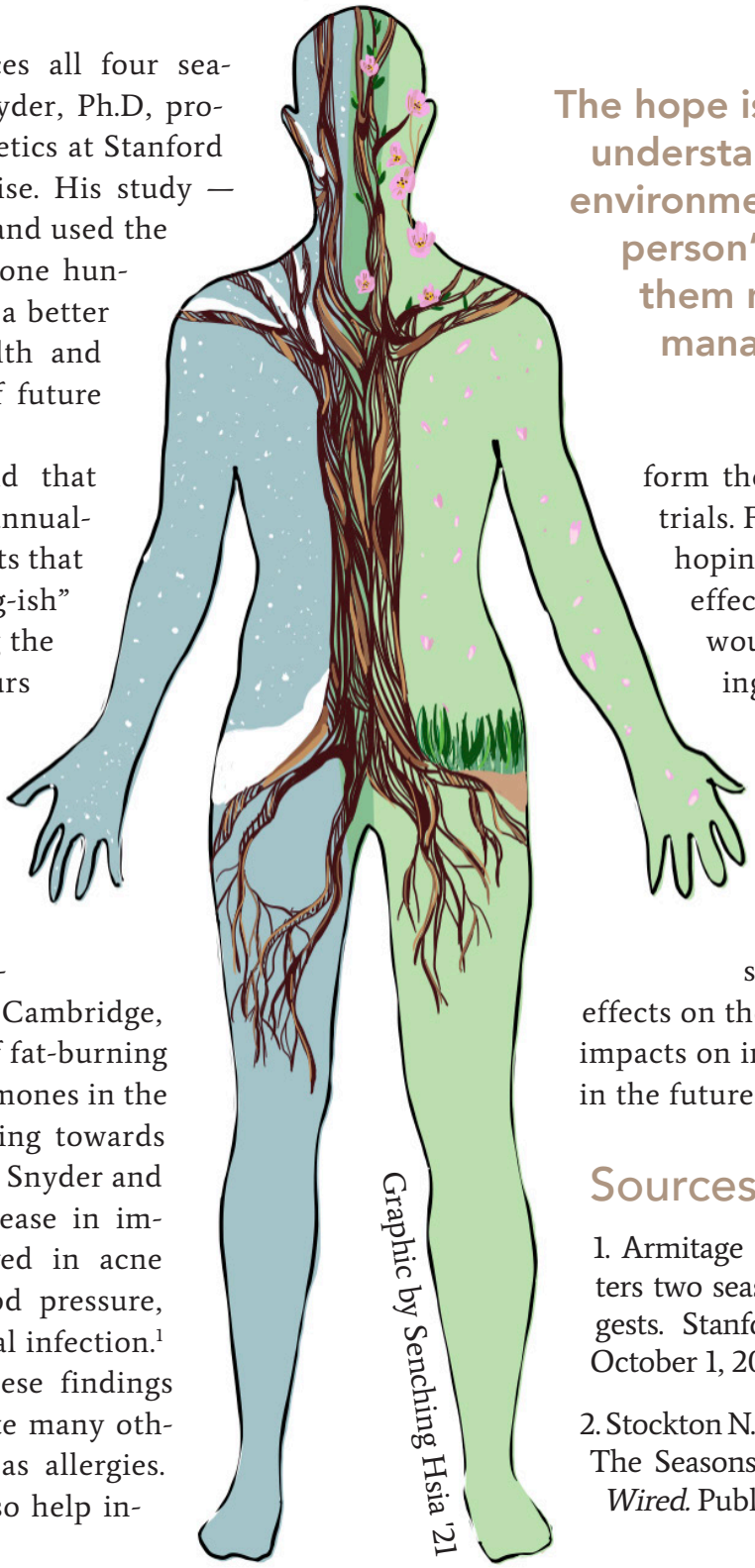
THE DUALITY OF THE BODY'S SEASONS

By Carissa Bruno '22

The body experiences all four seasons, right? Michael Snyder, Ph.D, professor and Chair of Genetics at Stanford University, says otherwise. His study — which lasted four years and used the molecular data of over one hundred people — provides a better basis for precision health and will guide the design of future clinical trials.[1]

Snyder's team found that the body does change annually, with two pivotal points that he likes to call "spring-ish" and "winter-ish." During the first period, which occurs in late spring to early summer, there is a rise in inflammatory molecules known to play a key role in allergies.[1,2] Another study conducted by Chris Wallace, an immunologist at Cambridge, found increased levels of fat-burning and water-retaining hormones in the spring period.[2] Progressing towards the early winter months, Snyder and his team found an increase in immune molecules involved in acne development, high blood pressure, and the fight against viral infection.[1]

Looking forward, these findings open doors to investigate many other health factors, such as allergies. These findings could also help inform the design of future drug trials. For example, researchers hoping to test a new drug's effects on blood pressure would benefit from knowing that high blood pressure spikes in the winter. Though people experience all four distinct seasons, their bodies do not, and this new understanding of the season's effects on the body poses significant impacts on improving human health in the future.



Graphic by Senching Hsia '21

The hope is that this new understanding of our environment's effects on a person's body will help them more proactively manage their health.

Sources

1. Armitage H. Human biology registers two seasons, not four, study suggests. Stanford Medicine. Published October 1, 2020.

2. Stockton N. Your DNA Changes With The Seasons, Just Like The Weather. *Wired*. Published May 12, 2015.

NEURA

TESTING THE BRINK OF

By Deven

Elon Musk, the eccentric CEO of electric car company Tesla and space exploration company SpaceX, is well known for his technological innovations. Dubbed "The Real Life Iron Man," Musk and his companies continue to be at the forefront of their respective fields. On August 28, 2020, Musk gave a presentation to showcase his third, and newest, company: a neurotechnology company called Neuralink. During this presentation — which was broadcasted on YouTube — Musk showed the world his progress in the field of brain-machine interface and explained his ambitions for this technology. With that said, what exactly did Musk achieve, and what does this technology imply for the future?

To the public, the star of the show was Gertrude, a pig that served as the main test subject during the experimental process of the new neurotechnology. Two months prior to his presentation, Musk placed an implant inside Gertrude's brain, which could sense when certain neurons fired, signaled by sounds played from a speaker. Through this, scientists could predict the pig's real life actions while walking, and perhaps most importantly, whether it was still healthy two months after receiving the implant.[1] However, neuroscientists weren't overly impressed by the implantation, as they had been able to detect electrical impulses from brains for decades now.

Nevertheless, just like his other projects, it would be Musk's engineering developments rather than his scientific ones that would leave a mark on the world. When Musk showcased Neuralink's new brain implants, he also presented an innovative method of inserting them — using floppy wires and a device similar to a sewing machine. While previous implants were more akin to metal spikes, Musk's implants were slimmer than human hair while containing more electrodes to better pick up signals. Given the delicate nature of the brain and its susceptibility to movement, stiff wires can cause great damage, making flexible wire implants a safer choice. Musk's method of implanting these wires involves employing a machine that uses a needle to poke approximately one millimeter threads into the brain. As wire implantation requires the utmost precision, this machine not only compensates for the difficulties that even the best surgeons will face but also prevents the brain from possibly shifting.[2]

Graphic by Melod

The most intriguing part of Musk's presentation was what he called "the link" — a coin sized disk containing computer chips that could compress and wirelessly transmit signals recorded from electrodes. Musk explained that "the link" could also be charged wirelessly via an induction coil, allowing for easy commercial use.[3]

As for his ambitions, Elon Musk is expecting big things from this project. At the baseline level, he hopes his new wire implan-

ALINK:
F NEUROTECHNOLOGY

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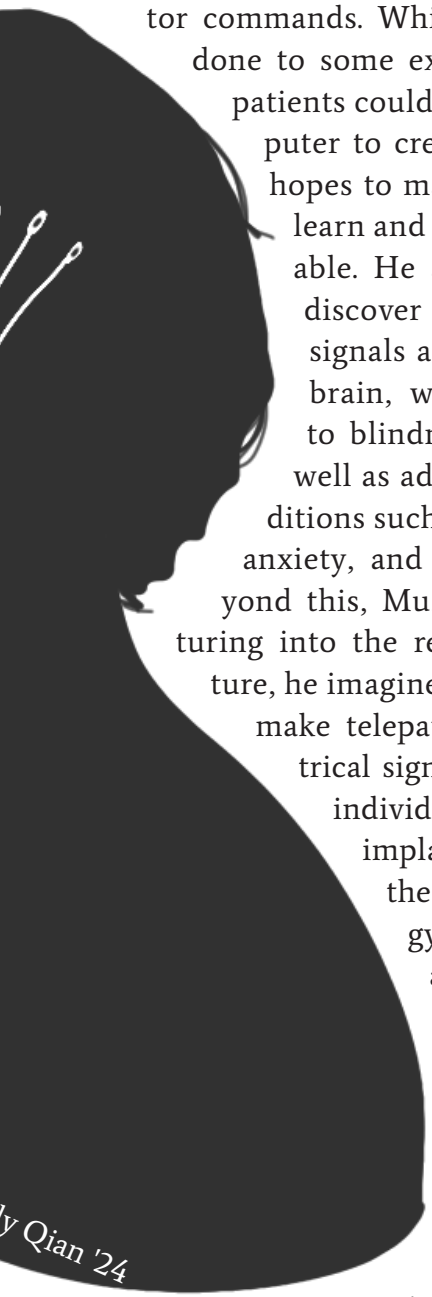
tation machine and "the link" can improve prosthetic devices by more effectively interpreting electrical signals and translating them into motor commands. While this has already been done to some extent — where paralyzed patients could move a mouse on a computer to create a command — Musk hopes to make this process easier to learn and more commercially available. He also hopes to eventually discover how to reverse electrical signals and actually stimulate the brain, which could offer a cure to blindness and hearing loss, as well as address more complex conditions such as insomnia, depression, anxiety, and addiction. However, beyond this, Musk's ambitions start venturing into the realm of sci-fi. In the future, he imagines that his technology will make telepathy possible, where electrical signals can be sent from one individual to another through implants. He also hopes that in the far future, his technology will be able to integrate artificial intelligence with the human mind, though that could have devastating implications.[1]



y Qian '24

In the end, Neuralink's most realistic and probable function will be to provide robotic limbs with the feeling of touch. The large number of electrodes used in Neuralink's implants could not only offer patients greater control of their prosthetic but also allow the electrodes to emit electrical impulses and stimulate the brain. Even though neural control of robotic limbs has been around since 2012, Musk's technology will be the first to allow a patient to feel through their synthetic limb. Although this may seem difficult to pull off, Neuralink's electrodes will not have to perfectly stimulate the right neurons in order to generate feeling because of the brain's amazing adaptation capabilities. According to Andrew Hires, assistant professor of neurobiology at the University of California, "over time the cortex is able to relearn and re-associate the electrical stimulation patterns. As long as there's a consistent relationship with what you're doing out in the world and what's going on in the brain."[2] If Neuralink's technology works as predicted, it might just offer paralyzed patients a chance at a normal life.

Sources

1. Lopatto E. "Elon Musk Unveils Neuralink's Plans for Brain-Reading 'Threads' and a Robot to Insert Them." The Verge. Published July 17, 2019.

2. Hamilton I. "Elon Musk's AI Brain Chip Company Neuralink Is Doing Its First Live Tech Demo on Friday. Here's What We Know so Far about the Wild Science behind It." Business Insider. Published August 26, 2020.

3. Regalado A. "Elon Musk's Neuralink Is Neuroscience Theater." *MIT Technology Review.* Published August 30, 2020.

A RUNNER'S PURSUIT OF THE PERFECT MASK

By Jayden Khuu '21

Motivation

On July 27, the Hong Kong government announced a new series of public health measures aimed at containing a sudden surge of COVID-19 cases in Hong Kong. One of the new guidelines mandated the wearing of face coverings in public spaces, without any exemption for physical activities, shocking me and other runners alike. If running in Hong Kong's 95-degree heat was a challenge to start with, adding a mask on top of that would be an absolute nightmare — or so I thought. Despite my concerns, I set out to discover the best mask for running.

Experimental Design

As a member of the Science Research Program quantitative section, a mere qualitative comparison between masks was out of the question. I needed hard data. To set up my experiment, I standardized my testing conditions by running five miles at a 8:00 min/mile pace around my house — a loop I ran frequently that would offer a more than sufficient pool of data for future comparison. After doing some statistical analysis (glorified Excel skills), I obtained a mean heart rate of 151 bpm, with a standard deviation of 5.68. These results would serve as the "control" group in this experiment, meaning that any new data that exceeded this range would indicate a below standard quality mask for physical activity.

For the experiment, I tested three masks: the traditional surgical mask, Adidas face coverings, and the Gill Mask, a brand specifically advocating eco-friendly, safe, and comfortable face masks. In addition, I added a mask support frame to serve as a barrier between my face and the mask to reduce moisture transfer and allow for easier breathing.

Source: Jayden Khuu

Surgical Mask without Mask Support Frame

Originally intended to serve as a control test, running with a surgical mask without the mask support frame turned out to be an utter nightmare. The surgical mask kept absorbing the sweat that had condensed on my face and soon became so soggy that I was almost suffocating. By that point, I forced myself to stop the test completely and swap into a new surgical mask.

Source: Amazon

Surgical Mask with Support Frame

Still scarred by the experience of near suffocation, I set out to give the surgical mask another try — this time with a support frame. Though

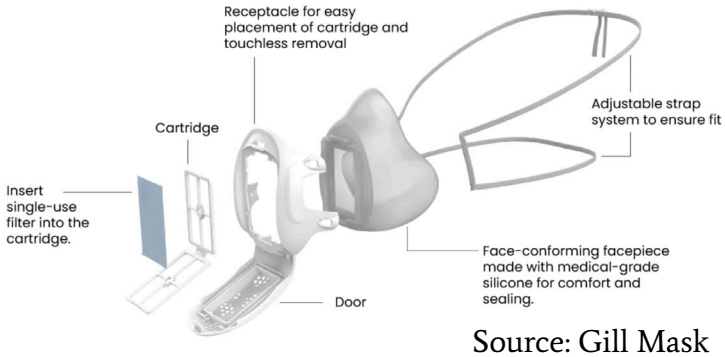
surgical masks have a bacterial and virus filtering efficiency (BFE and VFE) of over 95%, they are composed of electrostatics — a non-woven fabric material that makes the mask significantly less breathable.

Results:
Average Pace 8:01/mile
Heart Rate 157 BPM

While I definitely put in more effort to regulate my breathing during this test, I still felt like I could run for another 20-30 minutes. This result falls on the border of one standard deviation, meaning that the surgical mask was not ideal but at least an option to consider.

Gill Mask

I was very excited by the sport-oriented design of The Gill Mask. The mask's exterior resembles a respirator, with a comfortable air-tight silicone seal, and the interior contains a silicone rubber layer separating the filter from your face — just like a built-in mask support frame.



Source: Gill Mask

Results:
Average Pace 7:55/mile
Heart Rate 148 BPM

This data seems promising, and the design of the mask did in fact work well for the most part. I didn't encounter any breathing problems and felt almost as if I was running without a mask. However, due to its large and bulky exterior, the Gill Mask fell off twice during my run. The mask's design didn't consider that the silicone could become slippery (from sweat) during the run and failed to hold the mask securely against my skin. So, unless you plan on stopping multiple times throughout your run, I'd steer you towards our next option.

Adidas Face Coverings

Source: Adidas

The Adidas Face Coverings is made out of 93% Recycled Polyester and 7% elastane. Polyester is the primary material for most sports apparel, since it is extremely breathable. The mask also contains a small built-in pouch where filters can be inserted, giving you the option to add bacteria filtering capabilities as you please.

Results:
Average Pace 7:23/mile
Average HR: 161 BPM

Here's the part where I'd like to ask you to disregard the second part of the data. Though my average heart rate was higher, the Adidas Face Mask provided me with a feeling of liberation that I'd never imagined a mask could offer before. Because of its breathable material, I didn't have to put any extra effort into constantly catching my breath. Though the mask is overall light-weight and breathable, the fabric lining was slightly rough on the skin. Nonetheless, the Adidas Face Mask is the clear winner of this experiment and my current mask of choice for the fall cross-country season.

Overall, I am glad to report that none of my standardized testing data fell out of the previously calculated range of one standard deviation, which means that wearing masks for sports and everyday use is totally practical.

Writer's note: Please feel free to contact me for any questions on masks. I would love to help you pick a better mask.

THE RISE OF CO

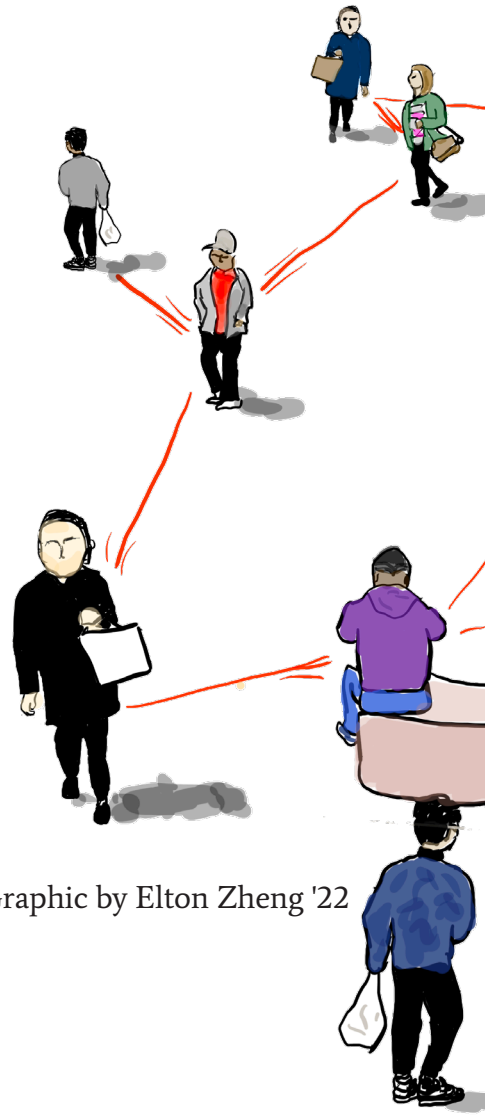
By Clarenc

As the COVID-19 pandemic continues to escalate, health officials are scrambling to keep the life-threatening disease under control. Along with developing a vaccine and ensuring public compliance with safety guidelines, health officials are also making use of contact tracing to further help control the spread of COVID-19.

Contact tracing is a tool that allows communities to curb the growth of highly infectious diseases like COVID-19 by identifying, notifying, and monitoring anyone who has come into contact with an infected individual.[1] The first step in the process of contact tracing is for anyone infected with said contagious disease to send their name to their local health department. These people are then asked to share the names of people with whom they had recently come into close contact (usually defined as within six feet). Within the next 24 hours, health officials will inform these close contacts of their exposure to COVID-19 while also making sure to keep private the name of the person who potentially infected them. These close contacts are then evaluated for symptoms and, in some cases, tested for COVID-19.[2]

Following the health inspection, there are two possible trajectories. If the close contact does not have symptoms or tests negative for COVID-19, they are asked to self-quarantine (staying home and maintaining social distancing) for 14 days, during which they stay on alert for any COVID-19 symptoms, check temperature twice each day, and send their local health department daily updates on their health.[3] On the other hand, if the close contact does have symptoms or tests positive for COVID-19, they are asked to self-isolate in a separate bedroom and bathroom from family and pets for at least 10 days, self-quarantine for another four days, and seek medical care immediately if they have more severe emergency symptoms of COVID-19 such as troubled breathing. They will also receive specific instructions on how to evaluate their symptoms and avoid spreading the disease to others.[2]

Contact tracing is essentially detective work. The process is very elaborate and creates a complicated web of correspondence with infected individuals and potentially infected individuals. As such, contact tracing is best suited for lower risk epidemics, where the complexity of the process can be properly managed. Given the sheer rapidity of the spread of COVID-19 and the unavailability of quick and reliable tests, contact tracing was not implemented extensively during the



Graphic by Elton Zheng '22

NTACT TRACING

ce Liu '22

early stages of the pandemic. Instead, health officials opted for more direct measures: social isolation and shutdowns. Now that COVID-19 cases are slowing down and health officials are more knowledgeable about the disease, contact tracing is proving itself to be a far more effective method of controlling the pandemic while allowing for less intrusive health mandates.[4]

Nonetheless, it is still critical for people to stay alert and proactive to prevent further quarantines. First off, people diagnosed with COVID-19 need to be honest about who they have come into contact with in order to give health officials as much information as possible. Secondly, businesses, schools, and other organizations need to take immediate action if any of their members are diagnosed with COVID-19. These organizations then need to act accordingly with guidelines even if it may seem unnecessary — whether it be sending out notices to all individuals who may have come in contact with an infected individual or closing down entirely.[4] Finally, all people need to stay cautious and follow the required safety guidelines. Though contact tracing can help control the virus, normal citizens nevertheless have to play their crucial role in slowing the spread and facilitating effective contact tracing. This means maintaining adequate social distancing, complying with state and federal guidelines, wearing a mask in all public spaces, and avoiding crowded events such as rallies or parties.

While not a complete solution to preventing viral spread within communities, contact tracing is a useful tool when dealing with the COVID-19 pandemic, as it notifies health officials of both infected and potentially infected individuals and offers very specific instructions for how to deal with those situations. Ultimately, it is necessary to rely upon not only contact tracing but also the collective responsibility of each person to continue doing their part in this global health crisis and to effectively contain this virus and potentially save hundreds of thousands of lives.

Sources

1. Contact Tracing. Department of Health. Published 2020.

2. Marshall, William F. Can Contact Tracing Stop Coronavirus? Mayo Foundation for Medical Education and Research. Published November 3, 2020.

3. Contact Tracing. Illinois Department of Public Health. Published 2020.

4. Thompson, Dennis. What Is 'Contact Tracing' and How Does It Work? WebMD. Published May 4, 2020.

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