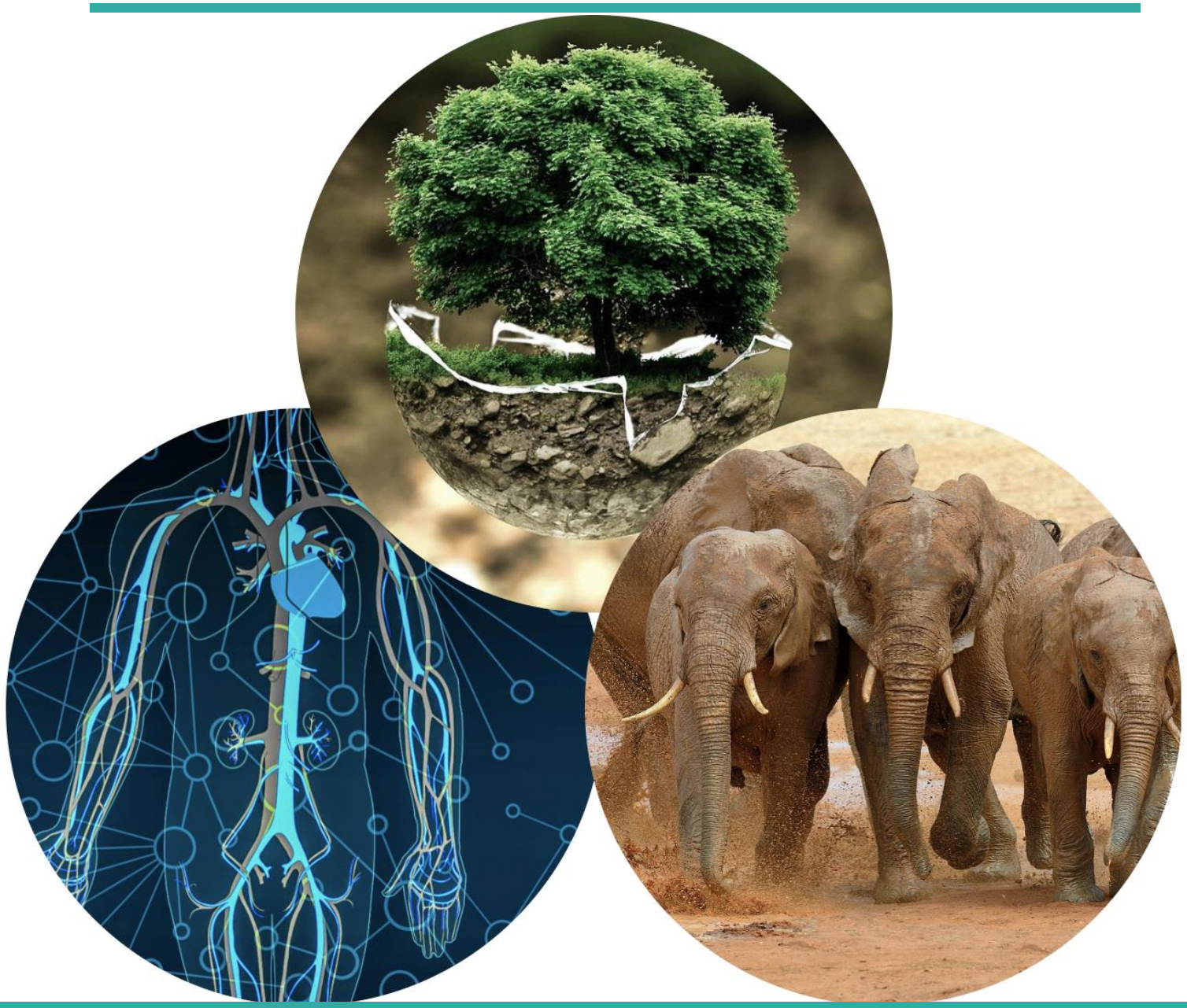


WRITING HEALS & INSPIRES

ONE HEALTH

FALL/WINTER 2022-2023 EDITION: VOLUME 3

Rutgers University One Health Club & RWJMS Women's Health Institute

Preface

Welcome to the third edition of the Writing Heals and Inspires Journal. Following the publication of the first two editions, we are excited to present our first entirely student-led edition of the journal. This edition illuminates student voices on the diverse applications of One Health: the concept that human, environmental, and animal health are all intimately connected and that interdisciplinary collaboration is essential for successful health outcomes in all three sectors.

"One Health" is a relatively new term for this concept, although it has been recognized for much longer. The idea that human health depends on the environment surrounding us was first conceptualized in Hippocrates's 400 BCE treatise entitled "On Airs, Waters, and Places." This was written as an advisory message for traveling physicians to consider the season, the climate, the quality of air and water, and the type and quantity of food being consumed in a particular region in regards to a patient's health. In the mid-1800s, German pathologist Dr. Rudolf Virchow was the first to establish a concrete connection between animal and human health when he stated "Between animal and human medicine there is no dividing line—nor should there be. The object is different but the experience obtained constitutes the basis of all medicine." He coined the term 'zoonosis.'

In the last few decades, 75% of emerging infectious diseases have been zoonotic in nature. In the 1980s, Dr. Calvin Schwabe coined the term 'One Medicine,' and started a wave of unified human and veterinary approaches to combating zoonotic diseases such as avian influenza. In 2004, the Wildlife Conservation Society hosted a collaboration between human and veterinary medicine experts to establish a "One World, One Health" approach to disease prevention. Various conferences and summits since then have continued to strengthen and codify the concept, augmenting official recognition and practice of interdisciplinary strategy. New Jersey and Rutgers are pioneers in these efforts. Thanks to the spearheading efforts of the Rutgers One Health Steering Committee, led by Amy Papi and Dr. Gloria Bachmann, the New Jersey is the first state to legislate a One Health Task Force.

As undergraduate advocates for One Health, students of the One Health Club are passionate about education and outreach and are excited to present their voices on the One Health topics we are most passionate about. With this journal, we hope to bring further to light the potential of One Health to guide our planet and its inhabitants to a healthier future. We express our immense gratitude for your attention and support, and hope you enjoy reading this edition.

Sincerely,
The One Health Club Editorial Team for The Writing Heals and Inspires Journal

Foreword

Dear readers,

The One Health Club was founded in 2020, just as the COVID-19 pandemic began to proliferate the globe. Although we started as a virtual group, through the support of the Rutgers One Health Steering Committee and Dr. Gloria Bachmann, we have now grown into an official two-year-old Rutgers student organization. Throughout these two years, we wrote a letter of support to assist the establishment of the NJ One Health Task Force, conducted educational presentations at fellow Rutgers organizations, established biweekly journal clubs to help our members think critically and grow their knowledge about One Health issues, hosted a One Health Panel, volunteered at Rutgers student farms, and ran a Paint-a-Pot campaign to teach children about gardening and raise money for a One Health Scholarship. The One Health Club also was invited to attend the Mid-Atlantic Regional One Health Consortium Conference, held on the Rutgers campus in August, 2022 and interface with the One Health advocates attending the meeting. We are humbled and gratified to play a role in the budding development of One Health as an official public health practice. As health issues inevitably continue to arise and medicine becomes increasingly intertwined with the environment and other organisms around us, we are excited to continue expanding our organization's reach and instill a passion for One Health throughout our surrounding communities through projects such as this journal.

Thank you for your time, readership, and support.

Warm regards,

Amy Li
President

Likhitha Patlolla
Vice President

Opening Remarks

Cheryl Stroud, DVM, PhD
Executive Director, One Health Commission

Greetings from the One Health Commission:

It is a great pleasure to share some thoughts about One Health for this special One Health themed issue of the Writing Heals and Inspires Journal led by the Rutgers Robert Wood Johnson Medical School Women's Health Institute. Congratulations and Thank You to the Institute for its leadership for One Health.

For those who are new to the term One Health, it is a global movement to help us understand and remember just how interconnected animals, environments and humans are to each other. We can't have healthy people without healthy animals, both wild and domestic; and we can't have healthy animals without a healthy environment. Basically, whether we are talking about natural ecosystems and all their creatures, about non-human animals (domestic and wild) or about populations of humans all over the world, none of us are safe until 'all' of us are safe and healthy. This One Health movement is a global 'Paradigm' for challenge driven 'Teamwork' to that safe and healthy world.

While it was zoonotic diseases (those diseases that pass between animals and humans; think rabies, influenzas, tuberculosis, Ebola, Nipah, SARS-CoV-2 that is causing the current COVID-19 pandemic) that brought the One Health movement to the forefront, we have realized over the past 20 years that 'many' of our most wicked challenges (climate change, antimicrobial resistance, disaster preparedness and prevention, bio-degradation, disease detection and control) are begging to be addressed using a One Health approach and lens. Such an approach brings professionals together from many diverse disciplines to join hands to solve shared problems with their collective knowledge and wisdom. This doesn't always happen in our current systems.

For maternal health, one of the most urgent and apparent One Health topics is environmental health. What girls and women are exposed to in their environment over a lifetime and during pregnancy can profoundly affect their health and the health of

their unborn child. I am thinking about contaminants like lead and other heavy metals, PFAS, BPDEs, and many other contaminants that are most often introduced into the environment by human actions. We need to help lawmakers and policy makers understand a One Health way of thinking so we are constantly evaluating what unintended, long-term effects some of our often well- intended human actions can have on health of current and future generations.

I am very pleased to see the topics being addressed in this special, One Health themed, journal issue. My hope is that these articles will open many deep, out-of-the-box conversations that will help us understand how One Health thinking can make us all healthy; but most especially mothers, be they human or animal.

And that we will ‘act’ on that awareness once it is awakened.

Laura Kahn, MD, MPH, MPP
Co-Founder of the One Health Initiative

As co-founder of the One Health Initiative, I'm delighted that the Rutgers Women's Health Institute has made One Health the theme of its 3rd edition of the Writing Heals and Inspires journal. One Health is the concept that human, animal, plant, environmental, and ecosystem health are linked. It provides an important framework to examine complex health issues such as chronic diseases, food safety and security, antimicrobial resistance, mental health, and zoonotic and vector-borne diseases, among others.

Many graphics have been used to illustrate One Health such as intersecting circles, an umbrella, a triad. I visualize One Health as a Rubik's cube with multiple intersecting dimensions. This visualization allows me to analyze complex health issues in a concise, systematic, and comprehensive way. The first dimension is composed of the One Health factors: humans, animals, plants, environments, and ecosystems. The second dimension provides scale: microbial/cellular, individual, population levels. The third dimension brings in the important political, social, and economic factors that impact health and can be represented as political borders at the local/regional, national, and international levels. The fourth dimension, which is not usually visualized, is time which can be divided into days, months, years, decades, or even eras.

It is my hope that the One Health approach is embraced by everyone as we strive to ensure a sustainable, healthy future for all species.

Bruce Kaplan, DVM, Dipl. AVES (Hon.), CDC/EIS63
Co-Founder of the One Health Initiative

The One Medicine-One Health concept/approach has expanded exponentially during the early 21st century. By definition "One Health is the collaborative efforts of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, plants and our environment." National and international implementation will help protect and/or save untold millions of lives in our generation and for those to come. This is extensively documented in current prominent One Health websites.

Having the One Health theme in this 3rd volume edition of the Writing Heals and Inspires journal is particularly significant. It will help elucidate the criticality of utilizing this interdisciplinary/transdisciplinary approach for managing today's pressing global and national public health, biomedical clinical research and environmental health issues.

Historically, stemming from Rutgers Women's Health Institute leadership in 2021, New Jersey was the first state legislature to establish a One Health Task Force. In addition, prior thereto in the 20th century, one of the most prominent and dynamic early One Health in Action scientific research teams was assembled and active under the auspices of the New Jersey State Department of Health.

Notably, the Rutgers One Health Club provides a valuable educational venue for undergraduate students and can help enlighten a wide spectrum of the general academic community.

The One Health Initiative Team strongly supports/advocates this visionary One Health activity.

Amy Papi
Co-Chair, NJ One Health Steering Committee

How do I begin---it was 2016 when the "One Health Initiative" was introduced to me by the Rutgers Robert Wood Johnson Women's Health Institute (WHI). With members of the Women's Health Institute, many One Health initiatives were undertaken to move this initiative to state-wide one, including connecting with NJ's species preservation sites. In addition to the numerous WHI stakeholders, other members were recruited. As a team, the following Mission and Vision statement was drafted by these NJ team:

Mission
To establish a transdisciplinary collaborative network across New Jersey that promotes the health and well-being of humans, all other species, and the environment.

Vision
Through the established principles of the Global One Health initiative, we promote the health of humans, all other species, and the environment locally, state-wide, and regionally through five major pillars. I was responsible for the advocacy focus of these five pillars, which are:

- Advocacy
- Clinical practice
- Community outreach/service
- Education
- Research

Establishing the similarities of humans, animals and environment and bringing together, veterinary colleges and medical institutions to collaborate and exchange research was what we achieved. We found that veterinarians, physicians, public health authorities, etc. can learn from each other.

Therefore, the next step that we addressed was to collaborate with other states. This was the beginning of the “One Health Regional Consortium”

I am extremely proud to be a member of the “NJ One Health Steering Committee” as Co-Chair along with Dr. Gloria Bachmann. Dr. Bachmann opened the door through the WHI for me to experience an issue that I am now passionate about bringing awareness to others and to assist people in understanding the health and well-being of humans, animals and the environment. I am proud of Rutgers University undergraduate One Health Club who are engaged in creating the 3rd volume of the “Writing Heals and Inspires” journal, a journal that was also commenced through the WHI. Thank you for allowing me to participate.

Michael E. Zwick, PhD
Senior Vice President of Rutgers Research

In early August, the Rutgers University's Office for Research helped convene a group of scientists, experts, and representatives from New Jersey, Delaware, Pennsylvania, Maryland, North Carolina, and West Virginia for a mid-Atlantic Regional One Health Consortium Conference. One Health is the interconnectedness of humans, animals, and the environment and shapes how research can best pursue solutions for these complex issues. I was pleased to have the opportunity to co-host the event with Gloria Bachman, MD, MMS associate dean for women's health and professor of obstetrics, gynecology, and medicine at Rutgers Robert Wood Johnson Medical School, co-chair of the New Jersey One Health Steering Committee, and core faculty member of the Rutgers Global Health Institute. The interdisciplinary and collaborative discussion that ensued helped cement Rutgers and New Jersey's leadership in One Health.

John R. Platt's seminal paper entitled "Strong Inference," published in Science in 19641 suggested that specific systematic methods of scientific thinking may produce more rapid progress than others. Scientists devise multiple alternative hypotheses, design crucial experiments, and conduct experiments to reject at least some alternative hypotheses and retain those hypotheses consistent with the data. Repeatedly performing this algorithm speeds discovery and advances scientific progress. The inherent complexity of One Health research requires a clear focus on the questions pursued and how scientists and policymakers will make progress. Because interdisciplinary research brings scientists from disparate fields together in pursuit of common goals, the One Health teams must collaborate to devise multiple alternative hypotheses, design crucial experiments, and perform these experiments. The nature of the specific experiments is broad. They may include direct manipulation in nature, laboratory experiments, or critical analyses of large-scale longitudinal data sets. Scientific meetings, such as the mid-Atlantic Regional One Health Consortium Conference, are essential for supporting the collaboration and interaction necessary to address the enormous challenges facing the health of humans, animals, and the environment.

The Rutgers University Office for Research looks forward to catalyzing and sustaining these vital activities in the future.

[1] Science, New Series, Vol. 146, No. 3642. (Oct. 16, 1964), pp. 347-353.

Francine Conway, Ph.D.
Chancellor-Provost, Rutgers University–New Brunswick

The “One Health” approach to solving our world’s grand challenges reflects the defining strength of Rutgers–New Brunswick. We proudly exemplify the ways higher education can foster intellectual cross-pollination for the greater good of our society.

As a great research institution, we aspire to find new links between the life, physical and social sciences; engineering; and the arts and humanities. Innovation occurs in the convening of faculty, staff, and students from these seemingly unrelated disciplines. The coming together of diverse perspectives leads to new insights that tackle pressing global issues of our time. Together we are strengthened in our response to climate, sustainability, cyber infrastructure, and security challenges. We accomplish and develop solutions to address the health of our communities, oceans, and even the human microbiome.

And we are poised to reach new heights of excellence through the implementation of our Academic Master Plan. In so doing, we will invest in creating interdisciplinary scholarly communities led by our world-class faculty, increase collaborative research opportunities and experiential learning opportunities for students, and engage in the full diversity of our campus community.

Also consistent with the One Health concept, the Academic Master Plan reflects a deep commitment to our campus community’s mental and physical health and well-being. With a new initiative called ScarletWell, we will take a public health approach to all aspects of our campus culture and resources.

In many ways, the Academic Master Plan represents scholarship with a purpose—to serve the common good. I am proud to see it heralded by our One Health Club and excited to see what we can accomplish when we work together.

Gloria Bachmann, MD, MMS
Co-Chair, NJ One Health Steering Committee

I would like to conclude the opening remarks section of this journal by emphasizing that humans, other animals and the Earth are in good hands with the next generation of One Health advocates, as exemplified by Likhitha Patlolla and Amy Li and their team. That despite the many ecosystem hurdles that all segments of society face when it comes to health and wellness, the vision and the proactive steps that are being taken by these students and the Rutgers One Health Club exemplify their commitment to making a difference. To their actively changing an environment that is becoming detrimental to all of us to one that is supportive and nourishing to all of us.

This also is the commitment of Rutgers University, as noted by the many climate and One Health initiatives that are ongoing here. And key to continued progress in the One Health vision is not only education about what each of us should do to preserve the Earth for all humans, animals and plants, but also what has to be done to reverse unwanted changes that have already occurred and to insure that these adverse changes do not occur again. And, this aspect of One Health can only be done through research and discovery. That is, the concept and vision of One Health cannot move forward without active research into what is best for our planet and what is best for all of its inhabitants. Two very recent initiatives to move discovery ahead was supported by the Rutgers Office for Research, under the leadership of Dr. Michael Zwick. The first was the mid-Atlantic Regional One Health Consortium Conference, the first of its kind on the East coast. This conference brought together in person and virtually professionals from six states as well as professional organizations who are involved in One Health issues. This conference ignited more discussion, more pathways, and more collaboration on how we can address many of the adverse environmental issues facing us. The second was the Research Incubator on Climate and Health that brought multidisciplinary teams together to explore ways to collaborate on serious issues that are adversely impacting our environment, our climate, and our wellness.

In conclusion, as Co-Director of the Women's Health Institute, we are joining with the Rutgers Office for Research in encouraging many of the Women's Health Institute

learners to get involved not only in educational and outreach initiatives, but also in One Health research projects. The Women's Health Institute, with the support of Amy Papi, my Co-Chair of the NJ One Health Steering Committee, has been committed to moving ahead One Health since 2016. Although some goals have been accomplished, we are actively embracing the many more issues that demand our attention and our expertise.

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Section A:

Invited Essays

A Passion for One Health

Anna Hausmann, DVM

One Health is a passion I discovered while studying Molecular and Cellular Biology and Animal Sciences as an undergraduate student at the University of Illinois in Urbana-Champaign. I entered my undergraduate career with the goal of becoming a veterinary medical doctor given my interest in medicine, health, and animals. I didn't know that experiences in my educational journey would open my eyes to an interdisciplinary field which combines all my passions into one. My training in veterinary medical school further solidified and expanded my understanding of how animals, the environment, and humans are intricately interconnected and recognizing the only way to solve the most pressing problems in the world (climate change, infectious disease, mental health, food insecurity, etc.) need to be addressed by a team of experts from multiple fields of expertise.

When most people think of One Health and animal experts, they think of infectious diseases. This is certainly true as many infectious diseases are zoonotic, meaning they spread from people to animals and animals to people. Veterinary medical doctors are on the front lines studying the most pressing diseases of our time including COVID-19, influenza, Ebola, cancers, and heart disease to name a few. Animal experts have a distinct advantage of being trained in comparative studies giving them the tools and skills to approach One Health problems.

What many people do not know is animal experts are involved in One Health beyond infectious diseases. While a veterinary medical student, I was part of starting an organization that provides free animal boarding, veterinary medical care, social work, and other resources to the homeless population in Madison, Wisconsin where I earned my veterinary medical degree. Many people may wonder, how does this relate to One Health?

In Wisconsin, it becomes extremely cold in the winters and homeless shelters do not allow animals in their facilities for understandable safety concerns. One effect is that

homeless individuals with pets do not seek warming shelters during the cold, and instead spend their nights out on the street with their animals. Our organization would house, care for, and provide for the animals while their owners would be cared for at the warming centers. Animals are an important aspect of the physical, mental, and emotional health of humans and when we recognize the strength of the human-animal bond, we can utilize it to promote human, animal, and environmental health.
Even today, students and I were discussing how obesity is a huge public health issue in both human and veterinary medicine. This is a multifaceted issue that should be addressed by teams of human physicians, human nutritionists, veterinary medical doctors, and animal nutritionists. These types of teams will empower people to make better lifestyle choices for both their own health and the health of their pets. It is much easier to make lifestyle changes when done in a collaborative environment and even easier when a loyal pet is involved in the process.

I couldn't finish this article without incorporating livestock, as they are another passion of mine. The food supply for the world relies upon the agricultural sector which includes species such as poultry, cattle, goats, sheep, pigs, etc. An often-overlooked aspect of One Health with these animals is related to the employee benefits. For many farm workers, there is no paid sick leave. That may not seem to be a One Health issue but consider this: A person working on a pig farm is infected with influenza and isn't feeling well. This person needs to go to work to get paid and arrives at their job while sick spreading the disease to the pigs. This is an example of zoonotic disease spread that could lead to a new variant of influenza as the pig's infection with the human influenza virus could mutate and infect more pigs, birds, and humans.

My passion for One Health is related to each and every way humans, animals, and the environment interact. One Health encompasses solar farms with grazing animals, the bond humans form with their beloved pets, the farmer who is feeding the world, the mosquitoes surviving in new regions, and countless more. Forming interdisciplinary teams of experts who use their vast knowledge and expertise to solve the planet's most pressing problems is the One Health solution.

Cigarettes and Electronic Smoking Devices: One Health Issues that Call for a Comprehensive Approach

Elena Cromeyer, MPH

The global burden of tobacco-related disease, disability, and death, along with the global burden of plastic litter caused by cigarette butts (CBs), and more recently, single-use electronic smoking devices (ESDs), negatively impact people, animals, plants, and the natural environment. The far-reaching effects of cigarettes and ESDs are One Health issues—traversing public health, tobacco control, veterinary and human medicine, ecology, environmental and conservation science, and public policy. They call for a comprehensive One Health approach to address the intersection of these different areas more effectively.

In the 1950s, tobacco companies added cigarette filters (CFs) to cigarettes and deceptively promoted them as a safer and healthier option, but research has disproven this theory (Harris, 2011). In fact, smoking-related morbidity and mortality increased during the years when filters became standard issue in the cigarette manufacturing process (Oren et al., 2020). Filters have also been shown to render smoking "easier" and "less harsh", increasing the sustained risk of smoking and enabling smokers to inhale more vigorously and for longer (Oren et al., 2020; Novotny et al., 2009; Song et al., 2017). Ventilation from CFs has been linked with an increased incidence of lung adenocarcinomas among smokers (Song et al., 2017). Equally important is the perception that exists among smokers and potential smokers about the mitigating factors of filters. Dispelling this falsehood is especially important since 99 percent of smokers in the United States (US) switched to filtered cigarettes within the last 50 years (Novotny et al., 2009).

Tobacco product waste (TPW) can also affect young children and babies, who can choke on CBs they pick up and ingest at home or on beaches and other environments. Nicotine in discarded filters is known to pose a serious risk to young children (Clarke,

2014). More than 13,000 calls to poison control centers from 2006 to 2008 involved kids eating CBs and studies show children aged 1 year or less are at most risk (Werner et al., 2016).

The harms from CBs extend beyond the health of humans. Cigarette butts are discarded into the environment as post-consumer TPW and eventually make their way to beaches and bodies of water. Since the Ocean Conservancy, a non-profit environmental advocacy group, began their annual beach cleanup in 1986, CBs have been the most common debris item collected along waterways globally (Slaughter et al., 2007). The 2015 cleanup found a total of 2,412,151 CBs, about half of which were found in the US (Ocean Conservancy, 2015). Similarly to what is occurring nationally and globally, New York (NY) is suffering from a significant accumulation of plastic litter. The most commonly found litter item in NY, nationally, and globally is CBs (Ocean Conservancy, 2021). Cigarette filters—a primary component of CBs, are primarily made of cellulose acetate, a plastic product with a limited ability for biodegradation (Maderuelo-Sanz et al., 2018; Novotny et al., 2009). Harmful chemicals released from discarded CBs, including nicotine, arsenic, and heavy metals, can be highly toxic to aquatic organisms and pose a serious risk to ecosystem health—affecting microbes, insects, fish, mammals and plants, as well as the food supply of humans (Green et al., 2019; Krueger et al., 2020).

Hudson River volunteers collected 38 tons of plastic trash along the NY-NJ Harbor Estuary during one day in 2018, with CBs being the most prominent litter (Fallon, 2018). A report by NY-NJ Baykeeper, a non-profit organization dedicated to protecting, preserving and restoring the ecology of the NY-NJ Harbor Estuary, indicated nearly 166 million pieces of plastic were floating in the NY-NJ Harbor Estuary (Fallon, 2018). More than 85 percent of these pieces were microplastics–debris from larger plastic, including CFs that break down into smaller pieces (Root, 2019; US Department of Commerce, 2018). Birds, fish, and other animals can choke or even starve to death from CBs; when these animals confuse them for food and consume them, CBs are not digested and fill up their stomachs, causing them to feel full (The LNP Editorial Board, 2018). Ingesting CBs can also poison animals with various toxins (Novotny, 2021).

The alarmingly rapid increase in the use of ESDs in recent years is a troubling and significant public health issue. Electronic smoking devices, used more by youth and young adults than any other age group in the US, are particularly harmful to youth and young adults; most ESDs contain nicotine, which is highly addictive and harmful to adolescent brain development (Truth Initiative, 2021; CDC, 2021). As the use of ESDs in the US rapidly increases, so does its environmental footprint. The waste from ESDs is potentially a more serious environmental hazard than CBs because ESDs introduce plastic, heavy metals, nicotine salts, lead, mercury, and flammable batteries to wildlife and into waterways and soil (Truth Initiative, 2021). Over 33 percent of all ESDs and refills sold at grocery and convenience stores in the US in 2018 were single-use products (Hendlin, 2018). There are greater environmental harms from disposable ESDs like single-use ESDs because of their limited life and more frequent disposal (Hendlin, 2018).

To address this pressing and complex One Health issue that traverses human, animal, plant and environmental health, NY state legislators and Governor Hochul should advocate for and enact the Tobacco Product Waste Reduction Act introduced in the NY Senate in the 2019-2020 and 2021-2022 legislative sessions to ban the sale or offer for sale of filtered cigarettes and single-use ESDs. A total ban on the sale or offer for sale of filtered cigarettes and single-use ESDs could lead to extensive advantages for population and environmental health, decreasing CB litter and proven harm to the health of humans, animals, and the environment from filters.

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Section B:

Student Voices

Plant-Based Diets and One Health

Amy Li

“Plant-based diets” refer broadly to a set of dietary restrictions generally seeking to minimize consumption of animal products, including vegetarianism, veganism, and pescetarianism. According to recommendations from nutritionists, these diets heavily emphasize high fruit and vegetable intake and reductions in red meats that often contain more fat. Compared with typical Western diets high in animal products, plant-based diets have been associated with lower risks of chronic diseases including obesity, cardiovascular disease, type 2 diabetes, and certain forms of cancer (Hemler & Hu, 2019). Although many raise concerns about insufficient protein intake, strategically composing plant-based meal plans can yield diets rich in necessary proteins, vitamins, minerals, and fiber without the excessive calorie intake that has become alarmingly common in high-income countries. Within recent years, the rapid growth of popular plant-based diets has been accompanied by the introduction of a vast and diverse variety of meat- and dairy-free substitutes in the food market. For many, vegan alternatives offer an avenue to enjoy pleasurable flavors and textures that may typically be inaccessible due to sensitivities and religious restrictions, thereby contributing to healthier relationships with food within a larger culture that often promotes maladaptive eating habits.

While it is no secret that plant-based diets offer rich nutritional benefits without the added factor of agricultural animal maltreatment, the growing market continues to have profoundly mixed implications within the food production system. Globally, food production is the largest contributor to loss of biodiversity through exploitative use of land, fresh water, and energy — with meat production as the largest culprit; production of one serving of beef or pork requires 1211 and 469 liters of water, respectively, as compared to 220 and 57 liters of water for dry beans and tofu, respectively (Nelson et al., 2016; Helmer & Hu, 2019). Similar discrepancies also exist between meat and plant-based proteins in greenhouse gas emissions. Indeed, the environmental effects of the lowest-impact animal products typically exceed those of vegetable substitutes (Poore & Nemecek, 2018). Still, it is important to holistically

consider the movement of food from farm to fork. Transportation of specialty and out-of-season fruits and vegetables can generate more greenhouse gas emissions than certain types of meat (Gray, 2020). Thus, while our integrated world allows for easy access to diverse food products from faraway lands, we must remember the energetic toll that facilitates that convenience.

Yet still, these privileges come with a human toll. Specialty crops only grown in specific regions of the world are frequently mass produced at the expense of local residents. If they are not exploited for their cheap labor, these residents cannot even enjoy the luxury products they export to foreign countries; Western demand for certain products such as avocado and quinoa have excessively inflated their prices beyond the financial means of those that rely on them within local areas. Indeed, some countries that support global supplies of specialty crops must introduce temporary bans on exports or consider imports from foreign countries to provide for their own consumption (Henderson, 2018). While consumption of these products are not restricted to those following plant-based diets, many specialty crops are staples in these food regimens that rely more exclusively on fruits and vegetables.

As the international population continues to grow on ever-shrinking resource reservoirs, the urgency of sustainable food production and consumption only increases. As conscious consumers, we must continue to review our dietary choices within the context of our global food production system and the ways it interacts with the physical space we occupy.

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Landfills – A Waste Management Strategy that Highlights One Health

Vanessa Thomas

Waste, trash, garbage. Concepts that are undeniably overlooked, yet incredibly present in our lives. We buy, we use, we throw out; never giving much thought to where the products of our lifestyles go after we put them in the trash bin. The waste that's produced finds its way into remote regions of the world, and expands ever more so in quantity with rapid consumption. Most often, the result of that rapid consumption ends up in landfills. Giant plots of land dedicated to one thing; our waste. These landfills located throughout the globe have effects that ripple through ecosystems, affecting the health of humans, animals, and the environment simultaneously. Without acknowledging the importance of One Health, the complete and interconnected effects of landfills cannot be considered.

Landfills are responsible for a number of environmental harms that decrease environmental health. Bacteria responsible for the breaking down of the organic material within landfills, produce methane during the process of decomposition (EPA, 2022). This process makes landfills a large source for emitting methane, a greenhouse gas many times more potent than carbon dioxide that contributes to climate change (IPCC, 2007). The sitting and decomposition of material within landfills leads to contamination of soil, land, and water by toxins and hazardous waste . Declining environmental health associated with landfills and waste similarly affects the health of humans and animals. Neither can survive in a world decimated by climate change driven by greenhouse gasses, drink safely from polluted waters, or thrive on contaminated land. The effect of landfills on environmental health has significant impacts on, and is innately tied to human and animal health.

Animals are similarly affected by the buildup of waste in landfills. The allocation of land for landfills alone requires the driving out of species, and the destruction of habitats. Improperly managed landfills are hotspots of animals to feed on; plastics, hazardous waste, and other forms of waste end up being digested by animals which disrupts their health and populations (Bittel, 2020). Leachate, produced when landfills' lining fails and leaks, can contaminate nearby water sources. This contamination produces dead

zones, and results in an inhabitable ecosystem for marine animals (Danthurebandara et al., 2013). Animal health is impacted by the direct and indirect effects of landfills. The health of the environment is dependent on functioning ecosystems, which rely partially upon the work of biotic factors. The demise of the health of species within an ecosystem as a result of landfills, coincides with the demise of the health of that ecosystem / environment.

It is no surprise then, that humans' health can be impacted by landfills. Being in close proximity to landfills can result in health issues such as headaches, nausea and nose/throat irritation (Njoku et al., 2019). These health effects compound on social justice issues such as environmental racism, since landfills are likely to be built by and operate in close proximity to low income and/or minority communities (Collins et al., 2016). Mental health is important to consider as well; the toll of living by a landfill and being constantly subjected to noise and odors can be exhausting. As humans, we must acknowledge our own role in the building and operation of landfills that have detrimental effects. We owe it to the Earth and those that inhabit it to prioritize the implementation of healthier, sustainable solutions to waste.

A single concept, landfills, is able to highlight the interconnectivity between human, animal, and environmental health. With seemingly ever growing consumption, the concept of One Health must be emphasized and prioritized in order for improvements to waste management strategies like landfills to be equitable, and fully considerate in their effectiveness and impact. The improvement of the landfill waste management strategy is an opportunity to see One Health manifest as greater health for all.

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Mother Nature Protests: A Look Into the One Health Impacts of Data Storage

Yashi Srivastava

The intersection between humans, animals, and the environment provides a unique outlook on a variety of issues. Personally, I was surprised by the impacts that One Health could have on the problem of data storage. The computational capabilities of major corporations are increasing, which leads to the establishment of more data centers. These centers increase in size and number to accommodate the growing demands for data storage. Since I have a passion for assessing the relationship between humans and technology (sociotechnical implications), I performed a deep-dive into these massive data centers. They are filled with several servers, maintained by humans. They are not only located in the midst of mother nature, but are constantly impacting their surroundings, including humans, animals, and the environment.

The most prominent One Health impact of data storage is the environmental impact. When discussing computational power, people like to bring up carbon footprint. Nowadays, some flight booking websites indicate the number of carbon emissions released by each flight. However, the Cloud—a variety of computing structures over a network contacting data storage facilities—"now has a greater carbon footprint than the airline industry [, as] a single data center can consume the equivalent electricity of 50,000 homes" (Monserrate, 2022). The Cloud is a force that takes part in our daily lives. Therefore, data centers have to be kept at a cool temperature to combat the heat waste product of computation which utilizes more electricity (Monserrate, 2022). To combat this issue, companies are looking to use cold water instead of cold air, which, unfortunately, puts a strain on water resources. For example, the nearby residents of the Utah Data Center - home to the U.S. National Security Agency - experience frequent water and power outages. Not to mention, these data centers are often situated in the very center of nature and natural resources.

While there is limited research on the impact data centers have on animals, there have been reports of animals breaking into the facilities. From squirrels damaging cable

wires to deer disrupting the daily operations of the centers, the wildlife seems to be fighting back. However, is blaming the animal justifiable, when their land has been taken from them? When data centers are created, the developments lead to habitat fragmentation, threatening local species. The construction of data centers breaks up undeveloped land into smaller disconnected parts, which destroys plant and animal habitats (Regelbrugge, 2022). This prohibits animals from moving around to acquire basic necessities: food, water, and space for raising offspring. Moreover, "habitat fragmentation associated with rural development triggers biodiversity loss…via a process called the edge effect" (Regelbrugge, 2022), which eventually impacts humans, too. Hence, the construction of data centers threatens the ecosystem by harming animal and plant habitats.

The impact of data storage on humans is apparent as well. As previously mentioned, the resources used by data centers deprive nearby residents of those resources. Moreover, the technology physically and mentally impacts humans. A relevant term in examining the impact of servers on humans is "acoustic waste", or noise pollution from the sounds produced by computing machines in data centers. The physiological effects of the noise produced by these machines include "hearing loss, elevated stress hormones like cortisol, hypertension, and insomnia" (Monserrate, 2022). A nurse reported increased blood pressure and cortisol levels as a response to the onset noise of the Cloud, while a software engineer was diagnosed with hypertension (Monserrate, 2022). Thus, the data storage machinery mentally and physically impacts humans.

After assessing the One Health impact of data storage, it is natural to wonder what humans can do on the individual level. While major corporations play the primary role in exacerbating the implications of mass data storage and computational power, there are actions people can take to lessen their space on data servers. The most prominent way is by reducing their digital carbon footprint. Believe it or not, actions such as deleting emails can reduce data stored in data servers. Unwanted emails and subscriptions lead to electricity being used to store the data in those emails (Garg, 2020). Additionally, individuals can look to setting limits for streaming videos and online games to minimize data storage, leading to fewer carbon emissions. While, at first, the impact of One Health on Information Technology seemed far-fetched, its

influence can be seen through the intersectionality of humans, animals, the environment, and technology. The intricacies of this socio-technical system not only resurface issues but also give potential solutions to reduce the harmful effects of data storage.

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One Health Approach to Fighting Malaria

Arsala Khan

Vector borne diseases have been one of the most significant threats to human health since the evolution of our species. They compose more than 17% of all infectious diseases and cause more than 700,000 deaths per year (World Health Organization [WHO], 2020). Malaria, the most prevalent, accounted for an estimated 241 million cases and 627,000 deaths worldwide in 2020 (WHO, 2022). In the most affected regions, specifically in the WHO Africa Region, where 96% of cases occur, malaria also results in long term social problems (Centers for Disease Control and Prevention [CDC], 2021). Due to illness, many lose days of work or school, resulting in decreased productivity and financial sustainability. Coupled with the expenses of treatment and prevention on both individuals and the government, malaria restricts the economic and social growth of entire populations. A One Health approach would be most effective in the long term and should be implemented to reduce the harm caused by malaria and other vector borne diseases.

Malaria risk is deeply intertwined with environmental health and is likely to increase in prevalence due to climate change and deforestation. The *Plasmodium* parasite that causes malaria is transmitted by the *Anopheles* genus of mosquitoes. The females of this genus lay their eggs directly on the water (CDC, 2022). Thus, people in areas with standing water are more likely to encounter mosquitoes that could pass on malaria. As global temperatures continue to rise, increased evaporation will result in higher levels of overall precipitation (Environmental Protection Agency [EPA], 2022). This would increase the amount of standing water and number of breeding sites in many areas. In Southern Africa, countries have experienced increased cases after unusual rains (Fernando, n.d.). The global rise in precipitation will not be evenly distributed. Due to shifting wind patterns and ocean currents, certain locations will actually experience a decrease in precipitation (EPA, 2022). This is unlikely to be beneficial; paradoxically, heavy rains can wash away breeding sites in specific areas. Climate change-induced alterations in precipitation patterns may make areas where heavy rains are protective

more vulnerable to malaria. For instance, in Colombia and Venezuela, malaria cases rose by more than a third following dry conditions associated with El Nino (Fernando, n.d.). Precipitation changes due to climate change, by creating or protecting breeding sites, have the capacity to worsen malaria transmission in endemic areas.

Temperatures are set to increase around the world due to global warming. Regions with higher temperature and humidity have increased rates of malaria transmission. Once the Plasmodium parasite is ingested, it must develop within the mosquito during its extrinsic incubation period (EIP) to become infective (CDC, 2020b). If the extrinsic incubation period is longer than the mosquito survives, the parasite will not infect humans. Higher ambient temperatures accelerate the development of the parasite, shortening the EIP and increasing the likelihood of transmission (CDC, 2020b). *Anopheles* mosquitoes themselves survive in more tropical and subtropical climates, but it is difficult to predict the effects of rising temperatures on their populations, as they cannot tolerate extreme temperatures (Agyekum et al., 2021). The effects of global warming on malaria incidence are different depending on location. For example, in Europe, rising temperatures have not increased malaria incidence due to other public health measures, such as improved drainage systems (Fernando, n.d.). In areas that are already burdened by malaria, or areas that are not accustomed to malaria and do not have the proper public health measures in place, precipitation changes and temperature increases could create malaria hot zones that would be devastating to health and economic systems.

Animals, by simultaneously being affected by malaria and influencing human risk of malaria, are also key components to consider. Out of more than 100 species of *Plasmodium*, only 5 are known to infect humans. Birds, reptiles, and other mammals can be infected by other species, with varying impacts (CDC, 2020b). Malaria is not equally detrimental to all animals. Different studies on the same species have yielded different results. One study has shown that female lizards with *Plasmodium* lay fewer eggs and male lizards with *Plasmodium* have difficulty defending their territories, but other studies have not shown this (Perkins et al., 2009). Hawaiian birds in particular have been known to suffer greatly from malaria. When malaria was accidentally introduced to the Hawaiian Islands, dozens of species went extinct due to severe

sickness (Perkins et al., 2009). It may be worth further research into the effects of *Plasmodium* on animals. If the parasites pose a threat to particular species, the changing environment and potential range expansion of *Anopheles* and *Plasmodium* could multiply that threat. In that case, malaria prevention could assist the efforts of conservation biology.

Animals also affect the feeding dynamics of mosquitos, which can be an advantage and a disadvantage to humans. Zoonotic prophylaxis and insecticide-treated livestock have been considered as preventative measures, with mixed results. Zoonotic prophylaxis involves using livestock to attract vectors and divert them from people (Franco et al., 2014). Insecticide-treated livestock bait vectors into biting them, causing their deaths (Franco et al., 2014). These techniques vary in effectiveness. Zoonotic prophylaxis would only be effective if vector density around humans does not increase to a point where it counteracts the diversion of vectors towards the livestock. Unfortunately, more animals living closer to humans could attract mosquitoes and increase their survival by providing access to more blood meals, a concept known as zoo potentiation (Franco et al., 2014). For example, a study in Indonesia found that, after adjusting for factors such as use of insecticide-treated bed nets and sewage canal conditions, participants who raised medium-sized animals in their homes were 2.8 times more likely to contract malaria than those who did not (Hasyim et al., 2018). The success of both preventative measures depends on how zoophilic the mosquitoes are. If they are more inclined to bite other animals, the animals would more effectively divert the mosquitos from humans. If, on the other hand, they are more anthropophilic, the animals may attract the mosquitoes, but they will preferentially bite humans, leading to more bites.

Finally, although most species of *Plasmodium* are not zoonotic, *Plasmodium knowlesi*, a species found commonly in monkeys in Southeast Asia, is capable of developing in humans. While *knowlesi* cases make up the minority, they have been on the rise in parts of Southeast Asia (Beaubien, 2016). The concern is that, as human activities like deforestation have allowed humans to encroach on monkey habitats, there is more consistent contact with monkeys. As a result of this proximity, mosquitoes carrying the parasite may be more likely to bite humans and infect them with malaria (Beaubien,

2016). *Knowlesi* may also evolve to infect humans more efficiently and become a major cause of malaria in people. In a lab, it was found that the parasite was able to find new ways of invading human cells by infecting older red blood cells (Beaubien, 2016).

A One Health approach would acknowledge these coming changes. As the environment changes, so will malaria distribution, and so must our response. Where rainfall will create breeding sites, we can focus on reducing the number of standing water containers and improving drainage systems. Such solutions would also alleviate issues outside of malaria, such as water-borne diseases. We can also use temperature changes to predict where vectors and *Plasmodium* will be more likely to survive. By understanding where malaria is likely to become a problem, locations with low levels of endemic malaria may be able to prepare by increasing the capacity of their medical services, improving housing, providing insecticide-treated bed nets, stockpiling vaccines and preventive chemotherapy medications, etc. Preemptively establishing safety systems could lessen the future impact of increased transmission. In areas with more zoophilic vectors, zoonotic prophylaxis or insecticide-treated livestock may serve as supplemental prevention methods that could provide an added layer of protection to communities. Similarly, in locations with zoo potentiation, maintaining human distance from animal habitats and providing community education about keeping livestock outside of the house may be beneficial. Finally, countries with *P. knowlesi* can increase surveillance for the parasite and enact measures to reduce human proximity to monkeys, like limiting encroachment. To conclude, malaria and other vector-borne diseases are currently major global burdens. With changing environments and case distributions, there needs to be a change in the way we cope with them. A One Health approach will not only enhance current efforts to fight malaria but can also impede future difficulties for populations around the world.

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Malaria and Maternal Health

Likhitha Patlolla

One of the largest applications of One Health is in the monitoring and prevention of vector-borne diseases. As humans living on a diverse Earth, we have a complex relationship with our environment and the other organisms that inhabit it. Infectious pathogens have adapted to the great deal of biodiversity in our ecosystems and maximize their transmission through the infection of a variety of different hosts. Vector-borne diseases are those that are caused by a pathogen that is spread between humans and another organism. The most prevalent vector-borne diseases spread via mosquitoes — Zika virus, West Nile virus, Chikungunya virus, dengue, malaria, and more. Unfortunately, there are always populations that are more vulnerable than others to certain diseases.

In 2019, 229 million cases of malaria were reported, with over 95% occurring in Sub-Saharan Africa (Badmos et al., 2021). Over 90% of the 409,000 deaths were also from this region. Additionally, the region is experiencing a rise in prevalence in Dengue fever, the Chikungunya virus, and the Zika virus (Mordecai et al., 2020). The environmental conditions and poor health infrastructure of the continent present a challenge to nations as they endeavor to prevent, detect, and treat cases of these mosquito-borne diseases.

Sub-Saharan Africa is also home to the highest maternal mortality rates in the region, due to high rates of poverty, child-marriage, and poor healthcare systems. In 2017, 85% of the 303,000 global maternal deaths occurred in Sub-Saharan Africa (Rodriguez, 2021). The intersection of these two pressing healthcare issues is a significant danger to pregnant women. Approximately 25 million pregnant women in sub-Saharan Africa live at risk of malaria (Gontie, 2020). Acquired immunity through previous infections wanes during pregnancy due to both host and parasitic factors, resulting in inflammation that interferes with regular pregnancy. The parasite causing malaria particularly targets the placenta, which disrupts nutrient transmission between mother and fetus. The effects of the disease are significantly amplified in a pregnant woman,

and can result in intrauterine growth retardation, maternal anemia, miscarriage, premature delivery, delivery of low birth-weight infants, and maternal and neonatal death.

Pregnant women in malaria-endemic regions should be receiving intermittent preventive treatment (IPTp) with a prophylactic antimalarial drug (typically sulfadoxine-pyrimethamine or mefloquine) during antenatal visits, especially during the second and third trimesters. However, drug resistance in the malaria parasite has been increasing, and some of these antimalarials may have adverse interactions with other antenatal medications like folic acid, or HIV medications like cotrimoxazole. Thus, it is important for more pregnancy-safe antiparasitic drugs to be developed, which will be best accomplished through the collaboration of environmental health/vector experts, drug developers, gynecologists, and infectious disease specialists.

Unfortunately, not all pregnant women receive regular antenatal care due to the poor access to healthcare in many Sub-Saharan countries, and cannot receive these drugs even if available. In these cases, prevention methods become the more efficient strategy, and include use of insecticide-treated bed nets and indoor residual spraying of insecticide. However, there is little evidence regarding how these interventions, which utilize many strong chemicals, impact pregnancy and maternal and fetal health, but their use continues to be strongly encouraged due to the overwhelming risks posed to women and their developing/newborn child by malaria infection. Once again, environmental health and insecticide manufacturers must communicate with physicians and infectious disease specialists to assist in understanding not only the effects of malaria, but also the products used for its mitigation on the health of women and children.

Without the One Health-advocated collaboration between environmental, animal, and medical experts, vector-borne diseases will continue to amplify the other challenges faced by the most vulnerable populations. When it comes to interactions between agents in the environment and human health and the health issues they create, it is only reasonable that we must consider all sectors in order to devise successful optimal solutions.

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Green Infrastructure

Muskan Patel

Green infrastructure is a method for managing water systems in a sustainable fashion that encompasses what One Health stands for. An issue in our current day is proper management for water systems since it impacts so many and on an environmental scale. One Health essentially aims to achieve health for all through examining the, “interconnected relationships between humans, animals, and the environment” (CDC, 2022). It improves communities which in turn improves the health of people. Through green infrastructure, we plant more trees and restore wetlands. It is stated that, “we also interfere less with ecosystems and animal habitats that new or industrialized water treatment plants are at fault for” (EPA, n.d.). Green infrastructure can solve so many issues in this aspect as well as reap benefits that everyone and everything can obtain in the One Health perspective.

The way green infrastructure works is by filtering and absorbing stormwater. The Water Infrastructure Improvement Act illustrates green infrastructure as “the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters'' (EPA, n.d.). This shows how beneficial this could be in a One Health perspective not only for humans, but for the environment and animals.

Humans are positively impacted by green infrastructure as they are able to interact more with their natural environment. Through this, they are less exposed to injurious substances that are damaging to our health. We would be less prone to respiratory diseases such as asthma or illnesses that pertain to the heart. In addition to better water management, there is less exposure to toxic substances that generate vector-borne diseases that are seen prevalent in low-income communities where there is not proper management.

Green infrastructure also aims to protect the environment. It provides a solution and a method in combating climate change, a major environmental and global issue we face today. Through this sustainable management, the air quality is improved as it "filters air pollutants and particulates" (EPA, n.d.). Water quality and quantity are also improved as it increases infiltration and changes the traditional method that contributes to negative impacts to the environment.

Through green infrastructure we also disturb less of the ecosystems. This makes animals in the ecosystem less vulnerable to our human, man-made impacts. There is more exposure to natural habitat and we would not create pipes and systems in the middle of the habitats disturbing animals. We make them less vulnerable to predation or harmful injuries that could result in death. One slight change at one level of the ecosystem creates disastrous effects on the whole scale of the ecosystem.

Green infrastructure provides the opportunity to provide better for us, our planet, and the animals in various ecosystems. Not only does it provide solutions to long-lasting issues we are faced with, it makes us take a look back and see how interconnected issues are in regards to One Health. By examining the topic of green infrastructure, the health of humans, the environment, and animals are emphasized. This makes me see the potential for all the other possibilities there are that we can use to combat issues in a One Health perspective to create positive change in the world.

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Lead Poisoning

Heather O'Donnell

One Health, which focuses on the interconnected relationships between animal, human, and environmental health, should play an integral role in the public health response to lead poisoning, a significant global environmental and occupational health issue. The Institute for Health Metrics and Evaluation (IHME) estimated that lead exposure accounted for 21.7 million years of healthy life lost and 900,000 deaths in 2019. The IHME also estimated that 62.5% of the global burden of developmental intellectual disability with no clear cause, 8.2% of the global burden of hypertensive heart disease, 7.2% of the global burden of ischemic heart disease, and 5.65% of the global burden of stroke were attributable to lead exposure in 2019. Notably, low- and middle-income countries have the greatest burden of lead exposure (World Health Organization, 2021).

Lead is a naturally occurring heavy metal found in small amounts in the earth's crust that endangers human and animal health. Lead exposure can occur by contaminated water, dust, soil, air, food, gasoline, or consumer products such as toys, paint, and batteries. Lead has no biological function in the body, and there is no safe blood lead level (BLL) (Hauptman et al., 2017). Risk factors for lead poisoning include low socioeconomic status, use of imported food, medicines, and pottery, living in housing built before 1978, construction, manufacturing, and mining occupations, and age younger than 5 years. Infants and children are at higher risk for lead exposure because they are more likely to put objects in their mouth and they absorb more lead than adults do.

Although primary prevention strategies such as banning lead in gasoline, paint, and plumbing have decreased children's BLLs, many children are still at risk of lead poisoning (Mayans, 2019). According to the Environmental Protection Agency, children exposed to lead suffer from anemia, growth disorders, organ damage, and impaired neurocognitive and behavioral development. Children exposed to high levels of lead often die. Adults exposed to lead suffer from reduced kidney function, reproductive

problems, high blood pressure, hypertension, and cardiovascular disease. These health effects are irreversible. (Environmental Protection Agency, 2021)

During the 2010 outbreak of acute lead poisoning, toxic levels of lead exposure in rural communities in northwestern Nigeria killed 400 children younger than five years within a 12-month period. The mass illness and death of livestock and waterfowl provided an early warning of lead contamination that was missed, as it preceded the mass illness and death of children. Physicians working for Medecins sans Frontieres (Doctors Without Borders) observed an unexpectedly high number of childhood illnesses and deaths in four villages when they screened for meningitis. Symptoms included headache, convulsions, vomiting, and abdominal pain (Centers for Disease Control and Prevention, 2016). Physicians later found that lead exposure from small-scale artisanal gold mining activities was associated with children's illness and death. Children's BLLs ranged from 168 to 370 ug/dL. For reference, the Centers for Disease Control and Prevention (CDC) recommends public health intervention when BLLs are greater than or equal to 5 ug/dL. The 2010 epidemic of childhood lead poisoning demonstrates that changes in animal health and behavior can aid in the detection of environmental hazards before they harm human health; simultaneously, human activity such as small-scale artisanal gold mining has a holistic and detrimental impact on environmental, animal, and human health (Edwards et al., 2017).

Global and regional systematic surveillance should incorporate animal health to monitor human health. The CDC manages the National Health and Nutrition Examination Survey (NHANES), which is one of the most comprehensive health surveys in the United States. The NHANES questionnaire should include topics related to observed mass animal illness and death and exposure to animal species that may spread zoonotic diseases. Ongoing surveillance of environmental, animal, and human pathogens and toxins can inform public health professionals of environmental exposures. The osteopathic medical profession can advocate for the One Health initiative by focusing on the health of the whole patient, which includes a patient's environment. Interprofessional education can help physicians recognize the relationship between humans, animals, and the environment (Edwards et al., 2017).

These One Health public health initiatives will prevent and mitigate the impact of lead poisoning and other environmental issues.

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Earthquake Safety and Mitigation Around the World

Sarah Levin

For over two-thousand years, people around the world have relied on the government to ensure their safety, protection, and comfort from earthquakes, tsunamis, and all natural disasters. Especially in the United States, our federal government has become one of the most exemplary governments in the world. In 1977, Congress first established the National Earthquake Hazards Reduction Program (NEHRP) to reduce fatalities, injuries, and property damage resulting from earthquakes (NEHRP, n.d.). Under the NEHRP lies the Federal Emergency Management Agency (FEMA), one of the largest, most crucial parts of America's natural disaster relief (U.S. Geological Survey, n.d.a). FEMA relies on the National Response Framework and National Disaster Recovery Framework to tackle emergency infrastructure repair and locate areas in need of FEMA grants (U.S. Geological Survey, n.d.a).

The NEHRP fuels earthquake research and ways to minimize the harm they cause. This organization has developed the United States Geological Survey (USGS) to monitor earthquake data going back to the 1831 BC Shandong province earthquake in China3. By studying past earthquakes and compiling data recording fault lines, mid-ocean ridges, P wave data, average rates of motion, epicenters, hypocenters, and even moonquakes3. The USGS and FEMA work together to develop building codes, design standards, and rehabilitation of vulnerable structures to best protect society from earthquakes and other natural disasters (U.S. Geological Survey, n.d.b).

Clearly, the United States government has established sufficient resources and allocated an exorbitant amount of money focusing on earthquake protection. However, other nations are not as privileged and ahead of the game when tackling natural disasters. Since 2001, 90% of the earth’s most violent earthquakes have happened in poorer countries such as Nepal and Haiti (U.S. Geological Survey, n.d.c). As a result of their limited resources, more impoverished countries are unable to mitigate disasters and protect their constituents from earthquakes. Even if they were

to spend resources to conceal the damage of one disaster, it seems almost pointless because the next disaster will ruin all of the work done prior. For instance, in Bangladesh, a densely populated country with 160 million people, it is almost difficult to decide where to allocate their limited resources: unpredictable earthquake mitigation or immediate needs such as healthcare and education (UNFPA Bangladesh, 2020). Not only does Bangladesh get many earthquakes, but the city receives a plethora of tropical cyclones, riverine flooding, and problems associated with rising sea level since a majority of the city is only ten meters above sea level.

These problems with the allocation of resources puts citizens of all impoverished nations at risk for property damage, loss of jobs, and even death. However, the world has larger entities, like the United Nations (UN), which has the capacity of educating earthquake-prone regions and providing assistance in small, localized communities. Through the UN, nonprofit organizations can be stationed in smaller areas that the federal government cannot control and spend money on. By allocating extra funding from each first-world country to the UN, more sufficient resources can be provided to struggling areas of the world, impacted by earthquakes.

For instance, the UN delivered hot meals to Haitian children in December to help recover from an earthquake that struck on August 14, 2021 (United Nations, n.d.). For over three months, Haiti has not been able to recover from the earthquake, but after this long period of time, the UN was able to step in. With more education, disaster training, and earthquake mitigation supplies in countries around the world, it could be possible to battle natural disasters with humanity. When the Puebla earthquake hit Mexico City in 2017, parents, teachers, and children did not have the proper training to know what to do and dozens of students died from earthquake damage right in the school (GlobalGiving, n.d.). As a part of the UN, more nonprofits such as Partners in Health, Humanity & Inclusion, and Doctors Without Borders should be established to tackle earthquake response in all areas of the world.

All in all, it is in the best interest of everyone in society to protect people from earthquakes. This isn’t a matter of being selfish or being the most progressive. This is a matter of life or death. Yes, national governments often have more resources and

more power over their citizens to deal with natural disasters, but we must think bigger, and essentially more directly, to ensure that everyone can get the help they deserve.

We should all be working together to ensure the safety of our world. Are you in?

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A One Health Look Into the Impact of Wildfires

Sarah Levin

In recent years, climate change, combined with harmful human activities around the world, has increased the occurrence of wildfires. In fact, 2020 was said to be a record-breaking year for wildfires in California, where occurrences are unfortunately common and annual (Buchholz & Richter, 2021). This phenomenon of wildfire outbreaks demonstrates the concept of interconnectedness that is central to One Health.

One Health promotes the idea of approaching challenges with a mindset that acknowledges how human health, animal health, and environmental health are connected and mutually impacted by one another. It further builds upon the fact that humans and animals are part of a shared environment, and regulating the well-being of all three categories is vital for life to prosper on Earth.

For years, humans have been informed of the increasing effects of global warming. As climate change continues to warm the Earth, it is leaving parts of the Earth drier than before. Extreme dryness, ongoing drought, and low levels of rainfall are all contributors to the high number of wildfires that have been occurring recently. Furthermore, wildfires work in a positive feedback loop, where they contribute to a hotter and dryer ecosystem that is even more susceptible to further wildfires. Wildfires are extremely harmful to our planet as they destroy the many trees that, by assisting carbon dioxide reduction, mitigate the effects of greenhouse gasses.

When wildfires burn down acres of forest, numerous species of animals lose their homes and, often, their lives. There is only a finite amount of space available for animals to reside in, especially with urbanization taking place at a higher rate in many areas around the world. In 2020, an inconceivable number of animals had lost their habitats and lives during the California wildfires. Unfortunately, these deaths went unreported as it was too difficult for officials to try and estimate the damage caused by the fire.

Fortunately to a lower degree, humans are also greatly affected by wildfires as they face similar challenges to animals. Due to wildfires, many families have lost their homes and few have also lost their lives. Furthermore, wildfires are shown to increase pollution and degrade air quality in surrounding areas. Smoke and air pollution can cause an assortment of health issues, from eye and respiratory tract irritation, to more serious disorders such as bronchitis, exacerbation of asthma and heart failure, reduced lung function, and even premature death (Environmental Protection Agency, 2022).

Wildfires, which many perceive as solely harmful to the environment, are, in fact, harmful to everyone. This concept of interconnectedness is what One Health stands for, as we can see the effects of the situation on human, animal, and environmental health taking place. We, as humans, have to depend on both animals and our environment for growth. If we remain ignorant of the roles each of us play in the world, we eventually will not have a world suitable for life.

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Water Quality

Genesis Isuiza

Water is all around us and within us. Approximately 70% of the Earth's surface is covered by water. Nearly 60% of the human body is composed of water. Water is essential to human health and necessary for many purposes, including dishwashing and showering. As such, water quality requires special attention for its safe consumption and use. Water quality can be approached through the One Health lens to see how it affects or can be affected by humans, animals, and the environment.

The environment affects the quality of the tap water that gets delivered to our homes and the bottled water that is purchased in stores. Environmental stressors or events, such as forest fires, rain, dissolved solids, and erosion, can all impact the quality of water. They can alter the pH and dissolved oxygen levels in the water. Therefore, the nearby environment can impact the safety of the water, as it can disrupt the process that water must go through to become filtered and ready for distribution (Zimmerman et al., 2008). Water quality can also be an indicator of the health of the surrounding environment by allowing us to infer what is occurring in an area based on the effects on nearby water sources. For example, wildfires can impact the temperature and turbidity of water sources in proximity, which would allow us to investigate changes in the environment beyond those affecting water quality.

Humans require safe water for more than just drinking. Water is needed to wash fruits and vegetables, boil foods, and to maintain sanitation and hygiene in the home. If water quality is poor with high levels of contamination, humans are at risk for contracting water-borne illnesses that can compromise health and result in disability or death. Thus, water quality requires proper maintenance and attention before distribution to ensure humans are interfacing with safe water.

Just as humans depend on water, so do animals. Animal health is determined by the absence of disease and the normal functioning of the organism. Hence, water quality also impacts their living and health. For example, fish require an aquatic environment

with a certain range of dissolved solutes and temperatures to function properly (Fondreist, 2013). Without the regulation of water quality, animals dependent on nearby water sources might have their health compromised by the consumption of this water. Additionally, animals can contract pathogens from water, which can be passed on to humans if food sources are contaminated and not handled properly.

The One Health approach allows us to see the interconnectedness of human, animal, and environmental health in relation to water quality. For many people in the United States, water is accessible within seconds by simply turning on the faucet or visiting a local grocery store. However, other parts of the world do not have access to water — much less safe water. Sometimes, necessity requires individuals to consume water that is available regardless of safety concerns. However, water safety and quality are crucial to human health; the One Health approach is required to analyze factors affecting it in order to implement changes that can ensure water quality control and improve access to safe water.

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E-Cigarettes

Anya Gowda

Drug use and, more specifically, vaping, are issues that impact not only human health but also environmental and animal health. I started advocating for drug prevention in high school to help create a safer and healthier environment for teens. I later began advocating for environmental issues and realized that there were many parallels that could be drawn between my two avenues of advocacy. Much of the work I do is interdisciplinary because, as One Health implies, the health of the environment, humans, and animals impact each other. Many issues result from larger systems such as capitalism. Vaping was a new way for Big Tobacco (the large, wealthy Tobacco corporations) to replace their dwindling customer base by targeting youth with a variety of flavors, using celebrities in advertising, and modifying device design similar to school supplies. These companies also lobby to ensure they can continue selling their products, even if it is detrimental to human health. Similarly, the environment and human health have suffered tremendously as a result of Big Fossil fuel companies prioritizing profit over people by expanding fossil fuel production, despite the known climate dangers. These companies also lobby to ensure they have support to continue profiting without legal consequences.

In terms of the concept of One Health, vaping impacts human health since most products contain nicotine, which is addictive, as well as chemicals that are not regulated nor meant to be inhaled, such as formaldehyde, diacetyl, heavy metals, and propylene glycol (American Lung Association, 2020). Just like how fossil fuels pollute the air, vaping pollutes your lungs and improper disposal of products pollutes the environment. More specifically e-cigarettes can hurt the environment by polluting it with plastic, heavy metals, nicotine salts, lead, mercury, and batteries (Truth Initiative, 2021). They are mostly non-reusable, non-recyclable, and non-degradable. Smoking traditional cigarettes also contributes to major environmental issues such as litter, air pollution, deforestation, water contamination, and soil contamination. Furthermore, vaping and smoking impact animal health through the inhalation of secondhand

smoke. Animals can also accidently ingest harmful substances like e-liquid that are not properly disposed of.

Overall, e-cigarettes illustrate the concept of One Health because they show that what can be harmful to human health is also harmful for environmental and animal health. It is important to address issues that impact the environment and animals because we are all interconnected and the issues also impact us. With a more interdisciplinary approach, we can have a better understanding of many issues and get to the root of the problem.

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Impacts of National Parks on One Health

Charita Darlapudi

There are many things that may come to mind when a person hears of One Health. The standard definition is an approach based on the belief that the health of people is interconnected with the health of animals and our environment. National parks have benefited all three categories of the One Health triangle. For humans, walking outside can improve heart health and circulation, decrease cholesterol, blood glucose, and blood pressure. Moreover, it can reduce inflammation and increase one's immunity, which can lessen the risk for certain diseases and cancers. Even spending twenty minutes outside can improve a person's concentration (US National Parks Service, 2022). Going to national parks for vacations contributes to reducing stress levels, anger, and aggressive behaviors. Additionally, spending time in nature will improve relationships with loved ones. The phrase "nature is healing" perfectly describes the benefits that spending time in the outdoors will have on a person's mental health.

Being outdoors in nature will not only strengthen relationships with other people, but also with nature itself. The amount of deforestation and pollution caused by humanity is continuing to have a severe impact on the environment, which will eventually send ripple effects throughout the other two parts of the One Health triangle. Protected areas, such as national parks, serve as a reminder that nature must be guarded, instead of exploited. The United States itself has over 400 national parks. Because a majority of them are protected from deforestation, these locations are indirectly responsible for preventing natural disasters such as landslides, erosion, and avalanches because the majority of them are not areas for deforestation. The large amounts of trees stabilize the land around them and even protect water sources (Cross, 2019).

Overall, national parks are great places for wildlife to thrive. This is due to the fact that, unlike other unprotected areas, the natural processes of the ecosystem are not interfered with. When tourists visit these places, they are merely acting as observers so the wildlife can live peacefully. Since there is little to no intervention, the

abundance of plants regulates carbon emissions by maintaining healthy amounts of oxygen and carbon dioxide. Having places that are guaranteed safety from harmful human activity for long periods of time also ensures that the animal species living there are able to prosper. A fairly large number of national parks were established with the intention to save certain ecosystems or geographical areas. Parks are reputed to be some of the most biologically diverse places in the world because of the strict laws against hunting, fishing, and, ultimately, any kind of development. National parks are further known to be very secure locations for endangered species to live. An example is the large amounts of endangered species, such as bison and gray wolves, that one can see at Yellowstone National Park (Woolford, 2019).

In addition to these points, the presence of national parks helps mainstream society and the economy. Some parks contain territory that supplies water to local residents. Other parks border rivers that generate hydroelectric power. Regarding economic impact, the amount of tourism that national parks generate contributes hundreds of millions of dollars to the American economy, alone. The need for tourism, in turn, creates jobs for hotels, restaurants, stores, tour guides, and more. Throughout the country, national parks are responsible for over 300,000 jobs (US National Parks Service, 2022). Although humans have a tendency to separate nature and themselves, the effects of greenhouse gas emissions and climate change will eventually impact us as well. Nature is not something that should be seen only in certain parts of the world; rather the entire world revolves around nature. No matter how humanity evolves in the future, nature will always play a crucial role in our lives. The giving of equal importance to all three aspects of the One Health triangle will ensure that humans, animals, and the environment are able to coexist in harmony.

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One Health's Impact on Deforestation

Heather Butler

Deforestation is a pervasive issue that negatively affects humans, wildlife, and the environment. It is a topic that I am particularly passionate about since it is actively being done in the community I live in. Due to deforestation's rampant destruction, it necessitates a quick and comprehensive response. In order to adequately address the issue, a One Health approach must be taken. One Health is the integrative effort of multiple disciplines working together to achieve optimal health for animals, people, and the environment; this lens enables us to identify overlapping problems within the topic of deforestation and implement interdisciplinary solutions (Centers for Disease Control and Prevention, 2022).

Although forests can be destroyed naturally—often through forest fires—deforestation tends to be defined as a purposeful act. Deforestation usually occurs due to the overexploitation of lumber by humans (Nunez, 2022). As a result of such overconsumption, humans are more likely to be subject to infectious diseases that were only once present in other organisms or limited geographical areas; for example, studies have elucidated the direct relationship between deforestation and yellow fever transmission (Vittor et al., 2020). The emergence of infectious diseases is caused in part by the increase in interactions with animals, as organisms are no longer bound to their particular niches; this destruction of habitats often elicits stress in animals (Stand For Trees, 2022). Furthermore, certain prey that may have been initially well-adapted to a forest environment will experience a heightened risk of predation. Deforestation also reduces certainsources of food and causes biodiversity loss. Consequently, ecosystems are disrupted: certain species may struggle to survive while others may completely diminish (Greentumble, 2018). In addition to humans and animals, deforestation also places a burden on the environment. For one thing, it greatly accelerates climate change (Gomes et al., 2019). Trees are great carbon sinks, which are reservoirs that absorb more carbon than they release; specifically, trees take in carbon dioxide from the atmosphere, which is a greenhouse gas. As a result of more trees being cut down, more carbon dioxide remains in the troposphere and absorbs

heat, greatly contributing to the warming of the Earth (Hu et al., 2021). Another environmental impact is that tree roots provide critical stabilization of the soil. Fewer root systems and less-penetrative roots contribute to soil erosion, conducive to landslides and floods. Further, land can also be more susceptible to desertification, which is when the topsoil degrades (Karamage et al., 2016).

There are many more consequences of deforestation; however, it is already evident that deforestation is an issue that poses a risk to all living things on Earth and requires a One Health solution. It is important to note that not all organisms contribute evenly to the problem. Humans are largely responsible for extensive deforestation—namely, corporations that partake in commercial logging and farming (Summer, 2020). In order to reduce deforestation and mitigate its harmful effects, several approaches can be taken. For example, recognition and protection of indigenous lands tend to result in improved land management and biodiversity (Pachamama Alliance, 2017). In addition, governmental apparatuses could put economic incentives into place to encourage planting more trees and preserving specific areas of land. On the individual level, we can donate and participate in deforestation conservation organizations and utilize fewer wood products when possible (Zimmer, 2019).

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Soil Health

Anya Gowda

A One Health issue I find particularly important is degraded soil health. This can result from practices such as industrial agriculture and can lead to food insecurity. During the COVID-19 quarantine, I started gardening and was able to grow my own food such as tomatoes, potatoes, and peppers. I noticed my own health improving since I was spending more time outdoors in nature as well as eating healthier, locally grown, and more nutritious food. I started looking into different ways to grow food, such as regenerative agriculture, and realized how essential soil health was to not only environmental health, but also animal and human health. Healthy soil can absorb more carbon, and therefore is a climate change solution. With high amounts of organic matter, it can also absorb more water during extreme weather such as floods, providing climate resilience and even water security during droughts.

Soil health also impacts animal health since there are various types of animals, such as earthworms, beetles, and termites, that live in the soil. The most common animals are protozoa, nematodes, mites and collembola. Animals not only depend on the soil but also play an important role in maintaining soil health by decomposing organic matter, mineralizing nutrients, controlling populations of pathogens, improving and maintaining soil structure, and mixing organic matter through the soil. Improved biodiversity in the soil can also lead to richer plant, bird, and insect populations.

Additionally, healthy soil can produce healthier crops, which impact human health. The increase in the monoculture of GMO (genetically modified) crops lacks the diversity that is needed for healthy soil, a healthy diet for people, and food stability. Industrial agricultural practices have depleted the soil by over tilling the land so it cannot absorb as much carbon dioxide. Furthermore, synthetic fertilizers and pesticides have introduced chemicals to the soil and have decreased its diversity. Despite these practices having expanded our food production, they are destructive to soil health and, hence, the health and security of crops. Therefore, it is important to look at a more holistic approach to farming that can maintain soil health as well as meet our

demands. Overall, healthy soil absorbs more carbon from the atmosphere, produces healthy crops, promotes food security, and is home to many different animals. It embodies One Health since it is intertwined with environmental, human, and animal health. Even starting small, like growing your own food or composting, can create a positive impact on your health and the environment.

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A One Health approach to addressing Black-White racial maternal health disparities in the United States, and COVID-19's implications

Yara Assadi

The medical and public health community have been sounding the alarm when it comes to the United States' elevated maternal mortality rates. The US has nearly the highest pregnancy-related mortality ratio (PRMR) among wealthy nations, at around 16.7 deaths per 100,000 live births. The statistics are even more troubling if the data is stratified by race and ethnicity: Black women in the United States have a PRMR of 40.8 while White women have a PRMR of 13, as of 2016 (Petersen, 2019). Though racial health disparities have been identified and validated through scientific inquiry, by institutions such as the National Institutes of Health, the Center for Disease Control, independent research institutes, and numerous universities, there are not enough extensive analyses on how maternal mortality is amalgamated by global, environmental, sociological, and interpersonal interactions with racism.

While racial bias in medicine is undoubtedly a contributing factor in the Black-White health disparity, the healthcare community would benefit from examining this crisis through the One Health approach: considering the multilevel and interdisciplinary contributors (Petersen, 2019). As medical programs and hospitals implement sensitivity and anti-discrimination training, the healthcare community must also acknowledge the contributors at large if sustainable change is to be reached. While the focus of this essay is on the United States, this model of examining maternal mortality and morbidity through the One Health lens can lend insight into innovative and sustainable solutions.

When the US faces the spread of global infectious disease, under-resourced and marginalized populations tend to carry the largest disease burden (Grief & Miller, 2017). One case study worth examining was the most recent pandemic of COVID-19, and how it struck certain communities harder than others. The Black community was

disproportionately impacted, with death rates doubling that of their White counterparts nationally, and in some states tripling of the infection rate (Ray, 2020). The cause of the disparity is likely multifactorial. In the Black population, systemic barriers such higher likelihood of being uninsured, food insecurity, housing insecurity, and reduced access to affordable medical testing were likely contributory, and most likely worsened over the course of the pandemic (Ray, 2020; Njoku, 2021). Moreover, susceptibility to underlying health conditions that increase one's risk of mortality from COVID-19 is increased in the Black population. Underlying conditions such as asthma, high blood pressure, and diabetes are exacerbated by environmental toxins that exist in predominantly Black communities, and by the lack of access to nutrient-dense, fresh food (4). These conditions can impact Black women during the antenatal period, and the widening of racial disparities in maternal health during the pandemic reinforce this conclusion. The maternal mortality rate among Black women increased from 44.0 to 55.3 per 100,000 live births between 2019 to 2020, while there was no significant change to the rate among non-Hispanic White women (Stephenson, 2022). The conditions of the antenatal care and delivery room also changed during COVID. With social distancing guidelines in place, numerous resources for pregnant women became restricted, with some hospitals implementing a one-visitor policy in the delivery room. This policy forced pregnant women to make the burdensome decision of choosing between their partner and a midwife or doula (Dongarwar et al., 2020). For Black and minority women, having a companion in the delivery room, especially those who act as advocates for the patient (i.e. doulas, family members, etc.) can reduce complications derived from bias, discrimination, and misunderstandings. Therefore, the restriction on who is allowed in the delivery room due to COVID-19 disproportionately impacted pregnant Black women (Robles-Fradet, 2022). The COVID-19 pandemic revealed the ways in which systemic racism makes mitigating both communicable and non-communicable disease extremely difficult for Black communities in the US, especially for birthing mothers.

When discussing maternal health, clinicians tend to focus on the factors within the patient's control, especially in the prenatal period (i.e. diet, exercise, smoking cessation). However, as previously mentioned, a patient's environment can also have devastating effects. This could not be illustrated better than when discussing environmental racism. The concentration of disadvantages is a historical legacy of

redlining, and it greatly limits the resources Black mothers have in their local communities (Ray, 2020). Black Americans, in comparison to Whites, are more likely to live in neighborhoods with a lack of green spaces, recreational facilities, healthy food options, lighting, and safety (Ray, 2020). Blacks are also exposed to lead at higher rates than White Americans as a result of environmental racism (Obeng-Gyasi, 2021). The legacy of redlining also impacts equitable healthcare access, which means that hospitals and pharmacies are further away from their neighborhoods (Ray, 2020). Prenatal care is also less often accessible for these women, especially since many Black women rely on public transportation, which was not recommended per social distancing guidelines (Ray, 2020). The burden of continuing prenatal care is typically placed on pregnant Black women, likely without the acknowledgment of the systemic barriers they face in seeking prenatal care.

After examining the global, systemic, and sociological lenses of racial health disparities, the healthcare community should acknowledge how the daily experience of racism impacts maternal health outcomes in individuals. One crucial concept to come out of 21st century analysis of racism and health is allostatic load: the physical manifestations of chronic stress, including as a result of racial discrimination and prejudices. The current scientific literature suggests that increased allostatic load is associated with premature morbidity and mortality from chronic diseases, especially cardiovascular disease (Peterson, 2019; Obeng-Gyasi, 2021; Lueth et al., 2022). The causes of maternal mortality also point to an association with allostatic load: cardiomyopathy, hypertensive disorders of pregnancy, and thrombotic pulmonary embolisms contributed to a significantly elevated proportion of maternal mortality among black women than among white women (Peterson, 2019). Allostatic load may also be the reason that racial disparities in maternal mortality are consistent even when controlling for protective factors, such as socioeconomic status and education, which are associated with improved health outcomes (Duru et al., 2012).

The COVID-19 pandemic exposed a plethora of barriers for Black mothers, and is reminding the American healthcare community of the insidious impacts of racism on maternal health. As illustrated in this analysis, the causes are multifactorial, but each factor is independently affected or amplified by America's pervasive racism.

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Section C:

One Health Regional Consortium

August 5, 2022

Ambassador Essays

Deforestation and Tick-Borne Illnesses in New Jersey

Evan Perkiss

The One Health Regional Consortium was extremely informative, but what interests me the most is the association between tick-borne illnesses and deforestation. Deforestation removes potential habitats for other animals, making ticks more likely to bite humans due to the resulting loss of other possible hosts. This could pose a significant threat in New Jersey, given that two species of ticks inhabiting this region, the lone star tick and blacklegged tick, can spread diseases.

The lone star tick (*Amblyomma Americanum*) serves as the vector for the *Ehrlichia chaffeensi*s and *Ehrlichia ewingii* bacteria, both of which cause Ehrlichiosis (Transmission | Ehrlichiosis, 2019). Symptoms of this disease include fever, chills, muscle aches, nausea, vomiting, and loss of appetite (Signs and Symptoms | Ehrlichiosis, 2019). Bites from the Lone Star tick also can cause allergies to red meat. Furthermore, this tick is known to be very aggressive (Fonseca, 2022).
The blacklegged tick (*Ixodes scapularis*), also known as the deer tick, is the sole vector of *Borrelia burgdorferi*, the bacteria that causes Lyme disease (Fonseca, 2022; Transmission | Lyme Disease, 2020). Although the ticks must feed on infected deer to pick up the bacteria, a tick that carries the bacteria can spread it throughout its lifetime (Transmission | Lyme Disease, 2020).

Deforestation reduces the number of animals within a given area, thus reducing the number of potential hosts for ticks. This, in turn, makes ticks more likely to bite humans. Although this means that the lone star tick could potentially infect more humans with Ehrlichiosis, one might assume that the decrease in deer could decrease the risk of Lyme Disease. However, once a blacklegged tick picks up *Borrelia burgdorferi*, it can transmit the bacteria whenever it bites a new host (Transmission | Lyme Disease, 2020). Therefore, although deforestation could decrease the number of infected deer, blacklegged ticks that currently serve as Lyme Disease vectors could potentially infect more people due to fewer alternate hosts. Educating people on how

removing woods could make lone star and blacklegged ticks more likely to bite humans could encourage them to oppose deforestation.

Medical Students' Perspective on the One Health Movement

Kelly Budge

Zoonotic diseases have become more familiar in the public eye due to the SARS-CoV-2 pandemic as well as the emerging Monkeypox public health crisis. The public may be less familiar with the beginning zoonotic transmission of HIV which later mutated into human-only strains. Other zoonotic diseases like Ebola have reemerging outbreak patterns from discrete contacts between human and animal species, and it is acknowledged the significance that persistent veterinary diseases play in the control of human disease as seen with the spread of TB within India and the necessary concomitant elimination of bovine TB. While these diseases highlight the significance of One Health, this concept is not limited to zoonoses.

The One Health concept addresses the importance of the interdependence of human health, animals, and the environment. While several research organizations currently work on these issues independently, the One Health initiative focuses on creating connections between all of the aforementioned health professionals, scientists, and state officials in order to put the concept into practice. As Dr. Cheryl Stroud, executive director of the One Health Commission phrased the significance of One Health, "It should not be in the middle of a pandemic or health crisis that these professionals of different fields are exchanging business cards for the first time."

This is not a new concept, but it is a new initiative focused on collaboration through direct conversation. Dr. Gloria Bachmann, the associate dean for women's health and professor of obstetrics, gynecology, and medicine at Rutgers Robert Wood Johnson Medical School initiated the NJ One Health Task Force and enacted Bills S347 and A1992 into legislation in 2021 to create these channels of communication between human, animal, and environmental health professionals, scientists, and state officials. Under Dr. Bachmann's guidance, representatives from these fields assembled on Friday, August 5, 2022, for a mid-Atlantic Regional One Health Consortium Conference

at Rutgers University to share their data and knowledge with the goal of expanding public health efficacy.

Through the Consortium, I have recognized the significance of the initiative and the necessity of its implementation in my professional training. As a medical student in my preclinical years, I have remained isolated from the other professions that I will one day work side by side with. Docherty and Foley recently analyzed 26 medical school curricula noting only 56% of the AMA-accredited programs included One Health subject matter (2021). But as I listened to each talk, from the new movements of ticks to a zoo's management of avian influenza, I was challenged by these unfamiliar specialties to gain a new perspective on how these ecosystems interact. One Health evokes a new way of problem-solving forcing us out of our own professional circles to better coordinate efforts and maximize the use of resources and knowledge across disciplines.

Docherty L, Foley PL. Survey of One Health programs in U.S. medical schools and development of a novel one health elective for medical students. One Health. 2021;12:100231. Published 2021 Mar 1. doi:10.1016/j.onehlt.2021.100231

Take-aways from the Regional One Health Consortium

Natalie Gonzalez

First of all, it was an inspiring meeting and impressive to hear so much about One Health, especially as I did not know much about it before. However, I remember participating in a One Health event at the Turtle Back Zoo during my time at the WHI in September 2017, where I first heard about the One Health Initiative.
Going to medical school and studying human medicine, I mainly focused on human health and never paid as much attention to animal and environmental health and how everything is connected with each other. Through the One Health Consortium, I learned about the importance of paying more attention to these interconnections. Therefore, my takeaway is to share more about the One Health Mission with friends, family, and colleagues, as the topics discussed are critical and affect everyone. As many diseases or pandemics start in animals and eventually spread to humans, I need to educate myself more about animal health as well. Especially the talk about the One Nutrition perspective was very eye-opening because it highlighted that unhealthy food or contaminated drinking water has a tremendous effect on us and how poor environmental health affects our nutrition. One Health also highlights how urgent it is to pay more attention to climate change and environmental pollution now.

In conclusion, learning more about One Health inspired me to be proactive and think about how I can contribute more to be part of positive changes. I am looking forward to future One Health Meetings!

A Medical Student's Thoughts on the One Health Regional Consortium Conference

Aishwarya Sridhar

As a medical student, I think the One Health Initiative brings light to the incredibly important topic of the interconnectedness of human health, animal health, and the environment. Attending the One Health conference reminded me that the environment and animal health can have a direct influence on human health. With our world facing two major global health crises, that of COVID-19 and Monkeypox, One Health has never been more relevant than now. Examples of other zoonotic diseases, diseases that spread between animals and humans, include Lyme disease, Zika, Ebola, Toxoplasmosis, and Swine Flu. I can only imagine how many lives could have been spared if we had had the foresight, technology, and education to prevent the spread of these diseases within animals and eventually to the human population. This made me realize just how crucial the One Health Initiative and its work truly is.

Physicians are usually trusted advisors of patients, so it is vital that we, as medical students, are well informed about the integrated nature of human and animal health to better educate our future patients. I realized that much of the information shared by the guest speakers was new to me. Examples of this included the talk on "The NJ Tick Problem" and learning about the many types of ticks and mosquitos and the large variety diseases they can spread. I think it would be beneficial to create future initiatives to further incorporate the interplay between animal health, human health, and the environment into the medical school curriculum.

I am grateful to have had the opportunity to attend the One Health Regional Consortium Conference to be a part of this important initiative and meet all the inspirational leaders involved. The One Health Initiative is creating interprofessional connections between veterinarians, physicians, scientists, and students and creating a platform in which people of various backgrounds can come together and educate one

another. I think this is a very powerful step towards a future of being able to detect and prevent zoonoses through better animal and environmental health, patient and provider education, and scientific innovation.

One Health Takeaways

Heather Butler

I am a part of the Executive Board of Rutgers' One Health Club, and we would like to thank Dr. Bachmann again for inviting us to the consortium. It was a wonderful opportunity to learn from various experts who have years of experience working with One Health ideals.

One of the takeaways I gained from the consortium was Dr. Stroud's pertinent message about forming relationships. She demonstrated to me the immediate need for different agencies and initiatives to establish connections and means of communication. In fact, it inspired our club to look towards collaborating with other Rutgers student organizations this fall in order to achieve a coalition of health clubs.

I also gained a sense of optimism and hope for the movement. It was interesting to learn about the history of One Health and how its been picking up speed in the legislative and medical spheres.

The event also left me in a state of awe and appreciation for the world around me in a philosophical sense, as everything in the biosphere is, as Dr. Stroud has said, "inextricably interconnected."

Using what I learned from the consortium, my club members and I plan on strengthening our mission and implementing more activities. In hindsight, last semester, we addressed the human and environmental aspects of One Health but did not spend much time on animal health; however, as many of the speakers demonstrated, animals are a critical part of the overall system. Thus, moving forward, we will ensure that all 3+ areas are covered.

A Medical Student's Perspective on One Health

Hema Dhanasekaran

Having attended the One Health Consortium held in New Brunswick on August 5th 2022, I first wanted to reflect on my understanding of what I had learned. The One Health concept is the idea that humans, flora, and fauna, are all interconnected and dependent on each other for survival and wellbeing. The goals of various task forces coming up around the world, including this Consortium, is to further this understanding by hosting avenues for interdisciplinary communication.

Second, I wanted to know what takeaways I should be focusing on as a 2nd year medical student who is about to start her rotations at hospitals. Since 2020, medical students, residents, and other healthcare workers, have overseen the care of a great number of patients with the zoonotic virus SARS-CoV-2 or COVID-19. In recent days, we also are made aware of the increasing case count of people infected with another zoonotic virus known as Monkeypox. It is obvious that there is a need for more communication between various experts, including physicians, epidemiologists, veterinarians, and many more. Keeping in mind the One Health concept during these extremely trying times may help us build better diagnostic tests, vaccines, educate healthcare and frontline workers, as well as develop new strategies to reduce upcoming hazards.

In the same vein, patient education remains a physician's utmost responsibility. We are trained in medical school to ask about the patient's social history - the environment that patients live in, the pets they have, and the diet they consume - and how these factors may affect their health. Having a good understanding about the biology of the patient, the agriculture they consume, as well as the pets and insects they interact with, fall very much in line with the One Health model. Educating future physicians with this perspective in mind will result in better health outcomes as physicians grow more competent in explaining to the patient how their health is tied to their social history.

As a medical student, I am biased towards weighing outcomes with a human-centric lens. Yet, attending this One Health Consortium allowed me to truly understand the importance of my role of preserving healthy interactions between human, plant, and animal, and broaden my view of what outcomes look like within each field.

One Health Club Editorial Team

Special thanks to the following members for their hard work and support in assembling the 3rd edition of the Writing Heals and Inspires Journal

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