HARVARD T.H. CHAN | SCHOOL OF PUBLIC HEALTH

NUTRI NEWS

The Department of Nutrition

May 2020

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HARVARD HONORS SIX NUTRITION STUDENTS IN ONLINE COMMENCEMENT CEREMONY ON MAY 28, 2020

Thursday, May 28th, marked Harvard's 369th Commencement in which the Harvard Chan community honored its graduates and conferred their degrees in public health in a virtual celebration. The Harvard Chan commencement was held together with Harvard University's commencement on the same day. The University's special online event began at 11:00 a.m. EDT and featured the president, provost, deans, and faculty of Harvard University conferring the academic degrees. A pre-show preview and music by the Harvard Bank began at 10:30 a.m. EDT.

The Harvard Chan School's Graduation Ceremony began at 12:30 p.m. EDT. Following the University event, the Chan School held an hour-long celebration. It included welcome remarks; the student speech from Nadhira Nuraini Afifa; the commencement address from Dr. Muhammad Ali Pate, Global Director of the Health, Nutrition and Population Global Practice at the World Bank; the alumni greeting from Carmon Davis; the announcement of awards by Dean for Academic Affairs Jane Kim; and the presentation of the graduates by Associate Dean of Student Services Robin Glover. Graduates from November 2019, March 2020, and May 2020 who have chosen to participate were also recognized.

The Nutrition Department is proud to recognize the extraordinary and remarkable achievements of six of its students this year.

Aviva Musicus, ScD

Aviva Musicus is graduating with an ScD in Nutrition. As a student at Harvard Chan, her research investigated the effects of food-related environmental and policy changes on human health and behavior, with a specific focus on the impact of food labeling, messaging, and marketing. Her dissertation built evidence for policies that could make it easier for people to make healthier choices through changes to the food environment. She specifically explored the effects of sodium warning labels on restaurant menus, the nutritional quality of free food in U.S. schools and workplaces, and the prevalence of front-of-package marketing claims and imagery on sugary drinks.

Aviva is from the Boston area and has enjoyed being close to family while re-exploring the city as an adult. During her time as a student, she has been consistently inspired by her peers and by Harvard Chan faculty and staff, and is incredibly grateful for the friendships she has made. Aviva will be staying on at Harvard Chan as a postdoctoral research fellow in cancer prevention with ***Drs. Karen Emmons*** and ***Steve Gortmaker***, and plans to continue her current research while expanding more into sustainability and exploring the cost-effectiveness of nutrition policy interventions. Outside of research, she hopes to spend the summer getting outside as much as possible (in a socially distanced manner, of course!), carving watermelon sculptures, and learning to speak French.

You Wu, PhD

I'm getting a PhD in Population Health Sciences (Nutrition field of study) with a SM1 degree in Biostatistics. While I was a doctoral student, I studied diet and other lifestyle risk factors and breast cancer in a large consortium as well as in the Nurses' cohorts, under the guidance of my advisor, ***Dr. Smith-Warner*** and my dissertation committee ***Dr. Willett, Dr. Giovannucci,*** and ***Dr. Molin Wang.***

I love love love Boston and I love love love my life here. This city has a positive vibe, yet it is not too busy or crowded. Everyone at Harvard Chan has been so nice; our department feels like a family. I feel blessed to have found what I enjoy doing and the group of people who I enjoy working with, and I'm lucky enough to stay here as a postdoc and continue my research on nutrition and cancer epi with ***Dr. Giovannucci*** and ***Dr. Yanping Li***.

Wish we could see each other soon after this challenging time!

Isabel Madzorera, ScD

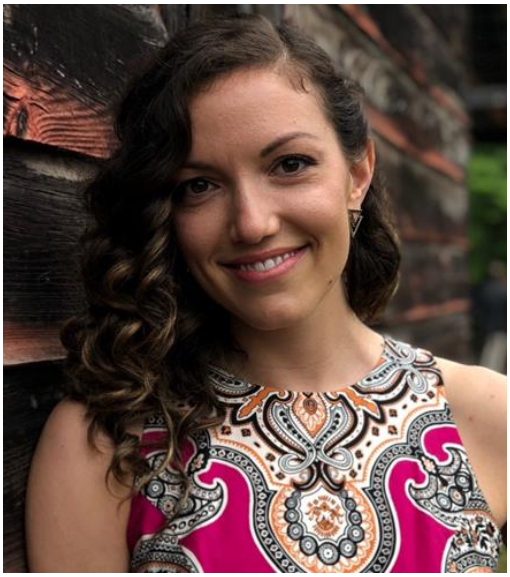
I have received my ScD in Nutrional Epidemiology. My dissertation research focused on the relationship between maternal and infant diets and nutritional outcomes in Sub-Saharan Africa. I really warmed up to Boston after having spent so much time here as a graduate student. It is easy to feel at home in Boston because it feels like a smaller city. I am currently a postdoc doing research under ***Dr Wafaie Fawzi***. My research now focuses on the influence of nutrition-sensitive agriculture, women's empowerment and the quality of food markets on diets and diet quality for women in rural Tanzania. I have the distinction of being the second Zimbabwean to graduate from the program in all of its years.

Jake Beckerman-Hsu, PhD

I will receive my PhD in Population Health Sciences, Nutrition with a research focus on
Early Childhood Obesity Prevention in Partnership with Head Start. It has been such a tremendous privilege and pleasure to be a student in the Nutrition Department. Of course, the research training is stellar; I have grown immeasurably in my ability to ask meaningful research questions, apply rigorous qualitative and quantitative methods, and effectively communicate the findings. Something else that will really stick with me is the relationships I have made along the way. I have had tremendous mentors and have developed such wonderful friendships with classmates who are brilliant and passionate about making a difference.

My next step is a move just down the road to Boston College as a postdoctoral fellow mentored by ***Dr Kirsten Davison***, Adjunct Professor of Nutrition and Social and Behavioral Sciences. I am excited to continue working with such an amazing team! My goal is to focus on food access, food insecurity, and diet quality in early childhood.

One fun fact about myself: Despite growing up in Connecticut, I had never visited Boston until accepted students day! For me, the best things about Boston are being able to walk to so many places and all the parks.



Simone Passarelli, PhD

I received my PhD in Population Health Sciences, Nutrition Field of Study. My dissertation title was "*Agricultural Interventions, Caregiver Perceptions, and Child Growth in Rural Ethiopia".* Although a Zoom defense was not what I had originally imagined, it was great to have so many family and friends attend who otherwise would not have been able to. There were folks from Ethiopia, California, North Carolina, and New York--including my 95-year-old grandma!

As someone born and raised in Massachusetts, it was great to come back after a few years in DC. It was great to be near family and friends, and get to know the city of Cambridge. My exact plans for the future are still TBD, but I'm currently looking at academic opportunities in the Boston and DC areas in global nutrition research and policy.

I'm extremely grateful for my experience as a student in the Nutrition Department. Everyone has been so welcoming, and so willing to lend a hand when you need it. I can't believe how much I've learned over the past four years. Thank you for everything, and please stay in touch!

Martha Tamez, PhD, ScD

I received a PhD in Nutrition & Epidemiology and ScD in Nutrition; my research focused on a traditional Mexican diet score, diet quality scores, and risk of hypertension among U.S. adults of Mexican heritage. One of the things I liked the most about Boston was (believe it or not) the weather! Coming from Mexico City, where it is about the same temperature all year round, it was very exciting for me to see New England's distinct seasons. Especially the springtime when the cherry trees are all in full bloom.

I transitioned to a postdoc position in the Nutrition Department doing research on diet quality, traditional Latino diets, and cardiometabolic outcomes among Hispanics/Latinos under the supervision of ***Dr Josiemer Mattei,*** Donald and Sue Pritzker Associate Professor of Nutrition.

The AJCN Sponsors Live Debate!

The American Journal of Clinical Nutrition will be hosting a live debate on June 3 at 1030AM. This debate will be hosted by AJCN Associate Editor and Professor in the Department of Nutrition, ***Dr David Ludwig***: The first topic for this meeting is:*"Public health guidelines should recommend reducing saturated fat consumption as much as possible",* and will feature the Pro, Con, and Discussion format.
Arguing Yes*: Dr Penny Kris-Etherton*, The Pennsylvania State University; **Arguing No: *Dr Ronald Krauss,*** University of California, San Francisco School of Medicine. **The Discussants:**
Discussants: ***Dr Arne Astrup***, University of Copenhagen; ***Dr. Frank Hu,*** HSPH; ***Dr Anahad O'Connor***, *New York Times.*

***To watch this lively debate*:** https://academic.oup.com/ajcn/pages/great_debates

NEWS FROM AROUND THE NUTRITION DEPARTMENT

AWARDS

June O'Neill, Research Data Analyst for ***Dr Josiemer Mattei's*** (Donald and Sue Pritzker Associate Professor of Nutrition*)* research group, has been awarded the Harvard Chan School Student Association Staff Recognition Award as part of the 2020 Graduation Ceremony. The Award honors exemplary staff members who have demonstrated a passion for enhancing the School community by strengthening the connection between staff, students, and faculty. After joining Harvard Chan, June seamlessly integrated into all team projects, vastly contributing to their productivity. She volunteered to mentor team members on their statistical analyses, providing a unique learning experience for students. Furthermore, June developed in-person and online training for the team and global collaborators on proper electronic data collection, best practices for data management, standard and advanced statistical procedures, and considerations for ethical human subjects' research. June has been integral in bridging the team's connections with other faculty at the School, as well as global partners. Through it all, June has an affable disposition and cooperative attitude that has made her an essential member and mentor to the group. We congratulate June for this highly deserved recognition, and appreciate her contributions to our Department.

GRANTS

The Training Grant in Academic Nutrition (T32) has been renewed for another five years through 2025 by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The program provides predoctoral and postdoctoral training in four key areas: Nutritional Biochemistry/Genomics/Metabolomics/Microbiome, Human/Clinical/Global Nutrition, Nutritional Epidemiology, and Public Health Nutrition. The T32 training program was established in 1993 by ***Dr Walter Willett***, then Chair of the Department of Nutrition at HSPH and ***Dr Allan Walker***, Director of the Division of Nutrition at HMS. Since 2013, ***Dr Frank Hu***, current Department of Nutrition Chair, Fredrick Stare Professor of Nutrition and Epidemiology at HSPH, has served as Program Director of this training program. The current training grant is co-led by ***Drs Frank Hu*** and ***Christopher Duggan***, Professor in the Departments of Nutrition and Global Health and Population at the Chan School and Professor of Pediatrics at HMS.

For more detailed information about the training grant, please see: https://www.hsph.harvard.edu/nutrition/postdoctoral-fellowships/

NEW PUBLICATIONS

Dr Sabri Bromage, Postdoctoral Fellow, and ***Dr Ganmaa Davaasambuu***, Assistant Professor, and colleagues have published results of the first detailed nationwide dietary survey of Mongolian adults. The survey found extremely high consumption of red meat and refined grains, widespread overweight and inadequacies of key micronutrients, and evidence of a shift away from a nomadic diet pattern toward an obesogenic urban one.

Bromage S, Daria T, Lander RL, Tsolmon S, Houghton LA, Tserennadmid E, Gombo N, Gibson RS, Ganmaa D. Diet and Nutrition Status of Mongolian Adults. Nutrients. 2020 May 22;12(5):E1514.

NUTRITION RESEARCH NEWS

Dr Frank Hu and Colleagues Examine Healthspan vs Lifespan

From Harvard Gazette

According to **Dr Frank Hu**, Fredrick J. Stare Professor of Nutrition and Epidemiology, and Chairman of the Department of Nutrition, in *the May 2020 issue of Nutrition Action Healthletter,* "People don't just want to live longer, [t]hey want to live longer without a major chronic disease." His team has examined what it takes to lengthen not just a person's lifespan, but also their "*healthspan*".

Hu says that "Two years ago, we reported that people with five healthy habits—eating a healthy diet, exercising regularly, keeping a healthy weight, not drinking too much alcohol, and not smoking—live more than a decade longer than those with none of those habits. So in our new study, we re-ran our analysis to look at life expectancy free of cancer, cardiovascular disease, and type 2 diabetes." Hu's team did not examine respiratory or neurodegenerative diseases because they did not have sufficient data yet.

Rather than look at how having or not having a single disease (or diseases) may affect a person's lifespan, Hu's study, which tracked roughly 111,500 people for 28 to 34 years, also looked at the impact of several healthy habits together. The upshot was that a 50-year-old woman with at least four of the five "low-risk" habits could expect to live to age 84 before getting cancer, cardiovascular disease, or type 2 diabetes. In contrast, a woman with none of the low-risk habits could expect to live to age 74 without those illnesses. A low-risk man could expect to live, disease-free, to age 81, rather than age 74. "That's really good news," says Hu. "It means that people who practice these healthy lifestyle habits don't just live longer, but better."

Hu notes that "Other behavioral factors—like better sleep habits—tend to accompany healthy lifestyles, but only a very strong risk factor could explain the impact of these five lifestyle factors." The researchers also adjusted for other factors like age, ethnicity, and a family history of diabetes, heart attack, or cancer. They also accounted for taking multivitamins, aspirin, and (for women) hormones. Their results fit with

other evidence. "We know that 80 percent of cardiovascular disease and 90 percent of type 2 diabetes are attributable to major lifestyle factors," says Hu.

However, the researchers found that cancer isn't as clear-cut. "Overall, smoking has the strongest effect," says Hu. Lung cancer is only one of a dozen cancers that it causes. He adds that "obesity is linked to a higher risk of several major cancers." However, Hu's study found that among people who had cancer, roughly 40 percent of those with four or five healthy habits—but only 15 percent of those with none—were alive after 32 years. People with diabetes and cardiovascular disease also lived longer if they had healthy habits. Bottom line: "These lifestyle habits may not only delay the onset of those diseases but also improve the survival of people who already have them."

Yanping Li, Josje Schoufour, Dong D Wang, Klodian Dhana, An Pan, Xiaoran Liu, Mingyang Song, Gang Liu, Hyun Joon Shin, Qi Sun, Laila Al-Shaar, Molin Wang, Eric B Rimm, Ellen Hertzmark, Meir J Stampfer, Walter C Willett, Oscar H Franco, Frank B Hu. Healthy lifestyle and life expectancy free of cancer, cardiovascular disease, and type 2 diabetes: prospective cohort study *BMJ* 2020;368:l6669

To read complete interview: https://www.nutritionaction.com/daily/aging/whats-your-healthspan/

Nutrition student Latifat Okara assists babies in getting a nutritious start in life

Latifat Okara
Photo: Kent Dayton

In a January visit to a Nigerian primary health clinic, ***Latifat Okara***, MPH '21, gave a seminar for local mothers about helping parents to feed their babies healthier food. Three years ago she went shopping for food for her own newborn daughter and was dismayed by the processed offerings. That inspired her to start a nutritional education company and online community called NomNom Babies. Okara came to Harvard T.H. Chan School of Public Health last fall. She is now weathering the COVID-19 pandemic back home in Nigeria, and thinking ahead to her next steps while she recovers from a semester spent juggling the challenges of family responsibilities and adapting to online classes.

Studies have shown that what babies are given by their parents at a very young age can establish preferences for healthy or unhealthy food that last a lifetime—with potentially significant health consequences. Okara says she herself was a picky eater during childhood. While she was growing up in Benin City, Nigeria, her grandparents used facial scarifications on her, a common local practice thought to be a remedy for children with bad feeding habits and regular illnesses. Although they meant the best for her, she said, she resolved that she would do things differently for her own children.

Okara said that "nutritional counseling and help accessing healthy foods are big gaps in Nigeria. Mothers want good health for their children, but so many can't afford good food and lack knowledge about nutritional basics." Okara saw that in cities, especially, traditional diets were being replaced by unhealthy packaged foods. To offer an alternative to commercial baby food, Okara launched NomNom Babies online in 2018. Through the platform, she has built up a community of more than 400 mothers from Nigeria and elsewhere who subscribe for recipes and nutritional advice. She hopes to eventually produce the organic fruit and vegetable purees, and partner with a government agency to distribute them to underserved populations at a reduced cost.

Latifat decided to come to Harvard Chan School to learn technical skills and policy ideas to help her build her company, and reveled in the opportunities offered during her fall semester on campus. She attended the School's Nutrition and Global Health Symposium, and went on a trip to Washington, D.C., organized by the School's Office of Career Advancement to visit public health organizations and meet with Harvard Chan School graduates.

She called what she's learned about nutrition at the School "an eye-opener. It's not enough to just provide a service, which was what I was doing. It's important to understand how drivers like racial discrimination, cultural beliefs, poverty, and maternal education determine food choices and preferences for families, globally." Okara, who is in the MPH-65 program, will finish her coursework in the fall semester. This summer, she's working on a practicum with the World Bank, where she will be taking a deep dive into primary health care initiatives to alleviate malnutrition in children under five living in low- and middle-income countries

From: https://www.hsph.harvard.edu/news/features/babies-nutritious-start-lifelong-health/

Researchers identify new 'metabolic signature' to determine adherence to Mediterranean diet and predict CVD risk

According to new research led by Harvard T.H. Chan School of Public Health with collaborators from the Broad Institute of MIT and Harvard and Spain, a newly identified "metabolic signature" can evaluate an individual's adherence and metabolic response to the Mediterranean diet and help predict future risk of developing cardiovascular disease (CVD). The metabolic signature, which can be measured through a blood sample, consists of 67 metabolites.

Blood samples from 1,859 participants from the Spanish PREDIMED study, the largest study of the Mediterranean diet's ability to prevent CVD, were analyzed. The study identified 67 metabolites that when analyzed collectively, indicated whether a person had followed the Mediterranean diet and showed how the person responded to the diet, which is high in unsaturated fats and emphasizes plant-based foods, fish, and olive oil, and has shown to be effective in reducing the risk of CVD and overall mortality. The study also showed that a higher level of the metabolic signature was associated with a lower long-term risk of CVD among PREDIMED study participants. Even after accounting for traditional CVD risk factors, the metabolic signature was effective at predicting long-term risk of CVD, the researchers said.

The researchers further tested and verified the metabolic signature in blood samples from 6,868 participants from the U.S.-based Nurses' Health Study, Nurses' Health Study II, and Health Professional's

Follow-Up Survey. They noted that ability for the signature to determine adherence and metabolic response to the Mediterranean diet, and to predict future CVD risk, were highly reproducible across all the study populations despite the fact that individuals living in Spain and in the U.S. have different dietary habits, lifestyles, and environmental exposures.

Assessing adherence to the Mediterranean diet has often relied on self-reported data obtained through questionnaires of study participants. The newly discovered metabolic signature could prove to be a potent and objective tool for the research community to further evaluate individuals' adherence and metabolic response to the Mediterranean diet in various study populations and settings.

According to ***Dr Jun Li***, research scientist of nutrition and epidemiology at Harvard Chan School and the first author of the paper, "The metabolic signature and metabolites included in the signature could also help researchers better understand how the Mediterranean diet can benefit people with complex metabolic diseases. Given that the metabolic signature is reflective of individuals' metabolic response to diet and CVD risk, the signature has potential in the future to help facilitate personalized nutrition interventions."

Added ***Dr Miguel A. Martinez-Gonzalez***, Professor at the University of Navarra (Spain), Adjunct Professor of Nutrition, and coauthor of this study, "From a public health perspective, our findings underscored the beneficial effects of the Mediterranean diet for the prevention of cardiovascular disease at a molecular level."

> "The Mediterranean diet, plasma metabolome, and cardiovascular disease risk," **Jun Li, Marta Guasch- Ferré,** Wonil Chung, **Miguel Ruiz-Canela**, Estefanía Toledo, Dolores Corella, **Shilpa N. Bhupathiraju**, **Deirdre K. Tobias, Fred K. Tabung**, Jie Hu, Tong Zhao, Constance Turman, Yen-Chen Anne Feng, Clary B. Clish, Lorelei Mucci, A. Heather Eliassen, Karen H. Costenbader, Elizabeth W. Karlson, Brian M. Wolpin, **Alberto Ascherio, Eric B. Rimm**, JoAnn E. Manson, Lu Qi, **Miguel Àngel Martínez-Gonzalez**, Jordi Salas-Salvadó, **Frank B. Hu**, and Liming Liang, online May 14, 2020, European Heart Journal, doi: 10.1093/eurheartj/ehaa209

Visit the Harvard Chan School website for the latest news, press releases, and multimedia offerings.

Photo: Gersh Kuntzma

On May 12, ***Dr Anne Lusk***. Research Scientist, presented her research titled, *"Temporary Separated Bike Lanes to Increase Safety and Demonstrate Demand"* before the UMass Amherst MassDOT Zoom roundtable. Drew Pflaumer, Bike Coordinator for Rhode Island, agreed to be Project Champion. ***Lusk*** also championed an explanded cycle track network during these COVID-19 times in a letter to the editor of *The Boston Globe.*
https://www.bostonglobe.com/2020/05/27/opinion/think-big-envision-bike-friendly-boston-area/

MONDAY NUTRITION SEMINARS

The Department of Nutrition holds its weekly **Monday Nutrition Seminar Series** every Monday throughout the academic year. The talks are varied, but they highlight the many different aspects of cutting-edge research that is currently being conducted in the fields of nutrition and global public health. These seminars are held from **1:00-1:20 pm** and are free and open to the public. Because of COVID-19, the seminars have been presented via Zoom since March of this past spring, and this zoom format will continue in the fall of 2020. A zoom link for viewing will be available one week prior to each seminar.

Our Monday Nutrition Seminar Series will resume on August 31, 2020.

Research Scientist Appointments and Reappointments

Dr Kassandra L. Munger has been promoted to Senior Research Scientist.

NUTRITION SOURCE UPDATES

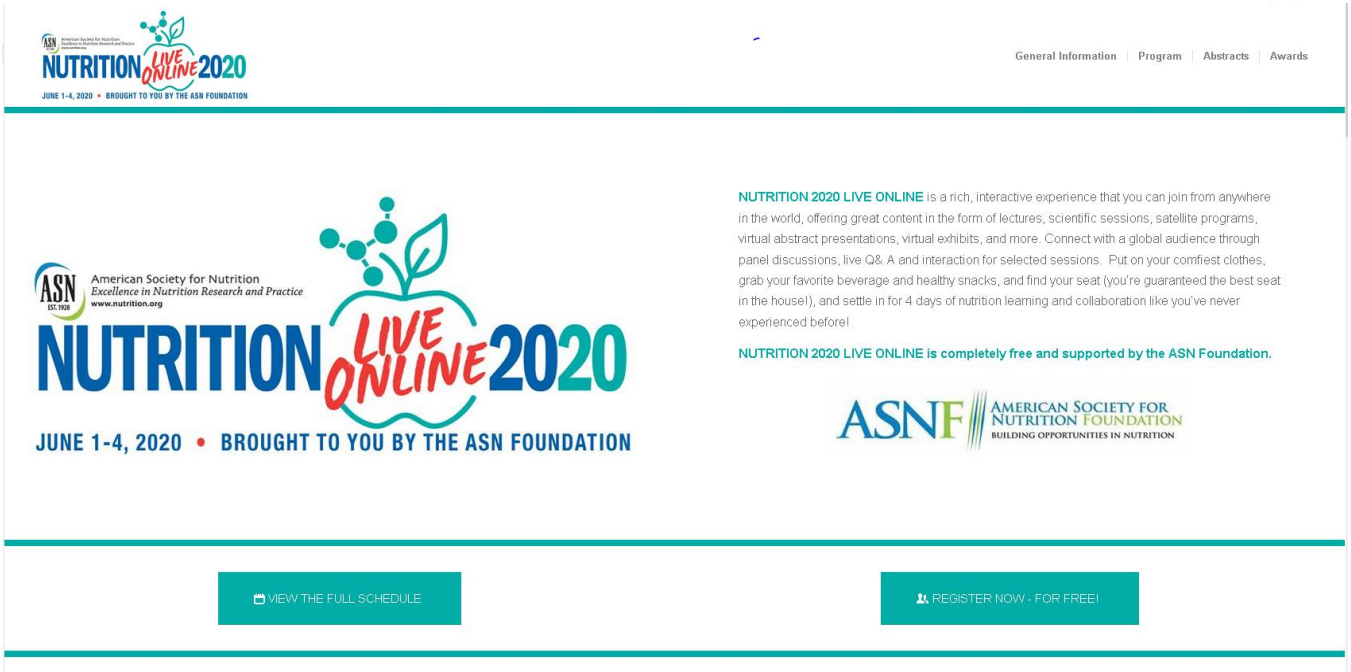
Strategies for Eating Well on a Budget
From the supermarket to the kitchen, here are some strategies to get the biggest nutrition bang for your buck: https://www.hsph.harvard.edu/nutritionsource/strategies-nutrition-budget/

Navigating Supplemental Food Resources
If you or someone you know is struggling to afford enough food to keep yourself or your family healthy, there are several options to help: https://www.hsph.harvard.edu/nutritionsource/navigating-supplemental-food-resources/

Nutrition and Immunity
Our immune systems are complex and influenced by an ideal balance of many factors, not just diet, and especially not by any specific food. Learn more: https://www.hsph.harvard.edu/nutritionsource/nutrition-and-immunity/

If you would like to remain current as to what is happening in the field of nutrition, please be sure to view our Nutrition Source website for the latest updates!
(See: https://www.hsph.harvard.edu/nutritionsource/)

The American Society of Nutrition will be holding its Annual Meeting online this year. To view the full schedule and to register: https://meeting.nutrition.org/



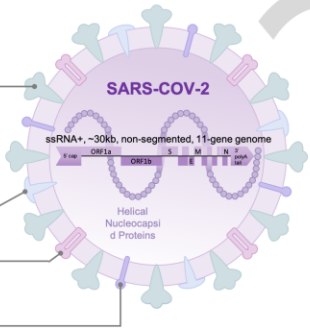
The online version of the ASN meeting could perhaps be highlighted https://meeting.nutrition.org

COVID-19: Coronavirus Disease 2019

Harvard Medical School *Module 1: From Bench to Bedside* Graphic Summary

VIROLOGY

SARS-CoV-2 is a new virus belonging to the Coronavirus family, which includes less pathogenic strains responsible for the common cold, as well as the viruses responsible for SARS and MERS. It is genetically related to the coronavirus responsible for the SARS outbreak in 2003; the closest identified relative was isolated from bats.



Spike (S) glycoprotein
- Trimeric structure resembling *corona* or crown
- Responsible for receptor binding, membrane fusion, and hemagglutinin activity
- Target for eliciting host neutralizing antibody
- Unique SARS-CoV-2 polymorphism enables S activation by human furin protein (found in lungs, liver, and small intestine), which may explain the association of COVID-19 with liver failure

Hemagglutinin-esterase (HE) protein

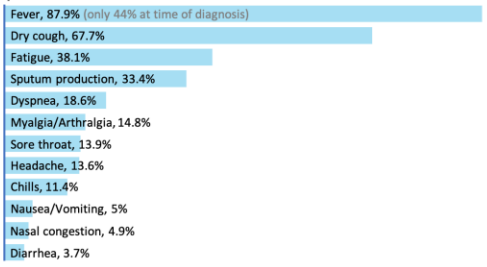
Matrix (M) transmembrane glycoprotein
- Most abundant structural protein
- Determines shape of viral envelope

Envelope (E) protein
- Interacts with M to form viral envelope
- Important for virus infectivity

Transmission
- SARS-CoV-2 is spread primarily via droplet, though it can be aerosolized and can persist on plastic and stainless steel surfaces for up to 72h
- Disinfectants with commercial concentrations of EtOH or H_2O_2 are effective

CLINICAL

Symptoms



Risk stratifying factors:
- Cardiovascular disease
- Hypertension
- Diabetes
- Chronic Respiratory Disease
- Cancer (any)
- Elderly, generally >60y
- Immunocompromised status

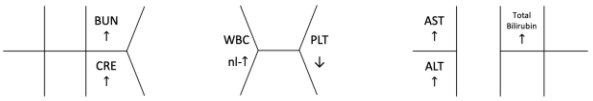
Full mechanisms not yet known

Partially mediated by:
ACE Inhibitor use
Angiotensin II Receptor Blocker use
Thiazolidinedione use
Ibuprofen use

→ Upregulation of ACE2 Receptor → Increased viral susceptibility

Diagnostic testing
- Currently a syndromic diagnosis of COVID-19 while awaiting definitive microbiological diagnosis
- RT-PCR against SARS-CoV-2 transcripts is the current gold standard diagnostic
  - High specificity
  - Variable sensitivity based on testing kit
- Serological antibody tests are in development and may detect both active and prior infection

Laboratory Findings



- Common findings: lymphocytopenia (most common laboratory finding), thrombocytopenia, leukopenia, ↑CRP
- Less common findings: ↑AST, ↑ALT, ↑CK, ↑D-dimer
- In severe cases: ↑troponin, ↑myoglobin, ↑IL-6, ↑procalcitonin, ↑LDH, ↓albumin

Imaging
- Imaging is not recommended for screening, but common chest CT findings include ground-glass opacities, consolidation, and crazy paving patterns, in a bilateral peripheral distribution

Clinical Course
- Clinical outcomes: mild disease, pneumonia, severe pneumonia, acute respiratory distress syndrome (ARDS), septic shock
- Case fatality rate (CFR) estimated at 2%, but given that many mild cases have gone undiagnosed, CFR is likely lower

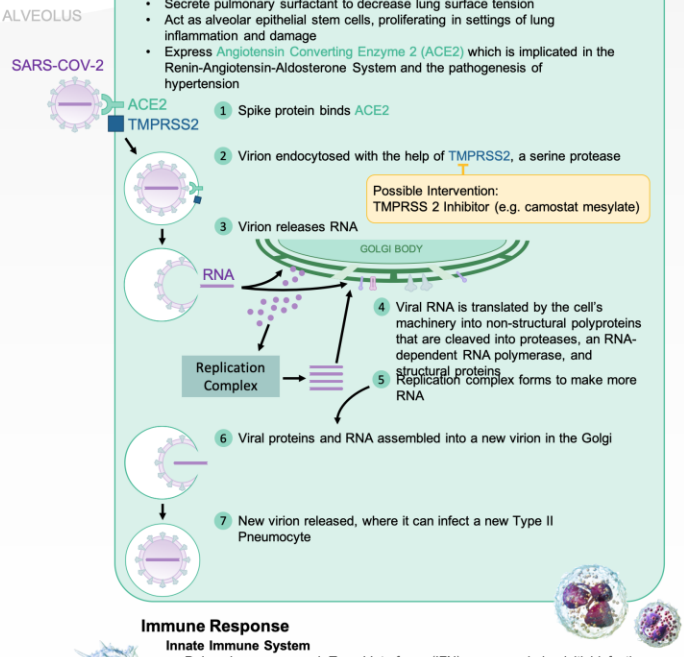
Investigational Treatment
- There are currently no FDA-approved treatments directed against COVID-19 at this time (03.19.20). However, a variety of therapies are under investigation. These include repurposing of
  - Antivirals: remdesivir, lopinavir/ritonavir
  - Antimalarials: chloroquine/hydroxychloroquine
  - Immunosuppressive medications: tocilizumab
  - Transfusing antibodies against SARS-CoV-2 analogs/SARS-CoV

Investigational Prevention
- It is expected that COVID-19 vaccine development will take a minimum of one year

PATHOPHYSIOLOGY

Type I Pneumocyte
- Simple squamous epithelial cell
- 97% of alveolar epithelium
- Thin, ideal for blood-gas barrier to adjacent pulmonary capillary endothelium

Type II Pneumocyte
- Cuboidal epithelial cell
- 3% of alveolar epithelium
- Secrete pulmonary surfactant to decrease lung surface tension
- Act as alveolar epithelial stem cells, proliferating in settings of lung inflammation and damage
- Express Angiotensin Converting Enzyme 2 (ACE2) which is implicated in the Renin-Angiotensin-Aldosterone System and the pathogenesis of hypertension



Immune Response

Innate Immune System
- Delayed or suppressed Type I Interferon (IFN) response during initial infection
- Viral replication triggers hyperinflammatory conditions and cytokine storm
- Influx of activated neutrophils and inflammatory monocytes/macrophages
- Serum neutrophilia and elevated pro-inflammatory cytokines are associated with severity of disease

Adaptive Immune System
- T helper cells Th1/Th17 are induced
- Specific antibodies not yet established
- Serum lymphopenia may be related to an antiviral response of bone marrow suppression

Treatment

	SYMPTOMS	MANAGEMENT
MILD	• Subjective or low-grade fever • Dry cough • Myalgias and arthralgias • Nasal congestion • Headache • Sore throat	• 14d home quarantine • Return precautions • Supportive care: encourage eating and drinking, acetaminophen for comfort/fever • Avoid or be cautious with ibuprofen

MODERATE	• High-grade temperatures
	• Shortness of breath/ trouble breathing especially if involving the need for supplemental oxygen
	• Chills
	• Profound fatigue
		• Airborne isolation
		• Supportive care: conservative fluid management, acetaminophen for comfort/fever
		• Respiratory support
		• Treat comorbidities:
		  • Suspected sepsis: empiric antibiotics
		  • Flu: oseltamivir
		  • Asthma/COPD: bronchodilators

SEVERE	• Severe dyspnea • Hypoxia • Dehydration	As above plus: • Advanced ventilatory support

tinyurl.com/MedStudentCOVID19Curriculum | tinyurl.com/MedStudentCOVID19Graphic

Figures not to scale. | Current as of 03.19.2020. | Please see bibliography in written module.

Student authors: Adi Achanta; Kendall Carpenter; Pamela Chen; Nicole Gilette; Pinky Langat, PhD; Blake Oberfeld; Jordan Said; Simone Sasse; Abigail Schiff, PhD; and Allen Zhou | Graphic by Blake Oberfeld