Summary Report

2017 Annual Grantees Meeting
The NIH-EPA Centers of Excellence on Environmental Health Disparities Research

December 4-5, 2017, University of New Mexico, Albuquerque, NM

U.S. Environmental Protection Agency Science To Achieve Results (STAR) Meeting Summary Report

Disclaimer

This document has been reviewed in accordance with U.S. Environmental Protection Agency (EPA) policy and approved for publication. The National Center for Environmental Research (NCER), Office of Research and Development (ORD) was responsible for the preparation of this meeting report. The document provides the abstracts, posters, and presentation slides from the 2017 Annual Meeting of the NIH-EPA Centers of Excellence on Environmental Health Disparities Research. This program is jointly funded by the EPA under the Science to Achieve Results (STAR) grants program, the National Institute on Minority Health and Health Disparities (NIMHD), and the National Institute of Environmental Health Sciences (NIEHS). This report is not a complete record of all details discussed, nor does it interpret or elaborate upon matters that were incomplete or unclear. Statements represent the individual views of meeting participants; except as specifically noted, none of the statements represent analyses by or positions of EPA. Reference herein to any specific commercial products, process or service by trade name, trademark, manufacturer or otherwise, does not constitute or imply its endorsement, recommendation or favoring by the U.S. Government. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government, and shall not be used for advertising or product endorsement purposes.

Acknowledgements

I am incredibly grateful for the unique privilege of organizing the second annual grantees meeting of the NIH-EPA Environmental Health Disparities Centers. It was truly gratifying to bring together some of the most brilliant minds and amazing talents around the profoundly important topic of protecting our nation's vulnerable population. The stunning beauty of the Comprehensive Cancer Center was only surpassed by the gracious and warm reception from Drs. Melissa Gonzales and Johnnye Lewis at the University of New Mexico, who accommodated our needs. The kindness and dedication of their phenomenal researchers, students, and staff was a remarkable punctuation. In fact, this report is made complete with the assistance of Dr. Joseph Hoover and his team of dedicated graduate students (Jennifer Ong, Chris Torres, and Lindsay Volk) who generously offered their service as note-takers for the break-out and listening sessions. In all, it was truly a pleasure to work with such a diligent group of individuals who were clearly committed to the successful outcome of this event.

I wish to express my utmost appreciation for the coordinating efforts of the Federal partnership managers, namely Drs. Symma Finn (NIEHS) and Nishadi Rajapakse (NIMHD), as well as Mr. Liam O'Fallon (NIEHS). I am highly appreciative of their hard work and steadfastness throughout the planning and execution of this meeting. A deep and heartfelt gratitude also goes to Ms. Hayley Aja, Student Services Contractor to EPA, for her creative contributions in development of this report. Her efforts are sincerely appreciated and greatfully acknowledged.

Sincerely,
Maggie Breville,
Health Research Program Manager
ORD/NCER, EPA

Contents

Final Meeting Day Group Picture

Commonly Used Acronyms

AER – Air Exchange Rate
ANA – Antinuclear Antibodies
AI/NA – American Indian/Native American
BMI – Body Mass Index
CAB – Community Action Board
CalStateLA – California State University – Los Angeles
CEC – Community Engagement Core
CETC – Community Engagement and Translation Core
CIEHR – Center for Indigenous Environmental Health Research
CNAEHER – Center for Native American Environmental Health Equity Research
CRAC – Community Research Advisory Council
CRESSH – Center for Research on Environmental and Social Stressors in Housing across the Life Course
CRST – Cheyenne River Sioux Tribe
CURE COPD – Comparing Urban and Rural Effects of Poverty on Chronic Obstructive Pulmonary Disease
DNA – Deoxyribonucleic Acid
EHD – Environmental Health Disparities
EMA – Ecological Momentary Assessment
EMIC – Environmental Monitoring and Interpretation Core
ETSU – East Tenessee State University
GIS – Geographical Information Systems
GKM – Gold King Mine
GPA – Grade Point Average
GPS – Global Positioning System
HEAL – Health Effects Across the Lifecourse
HOME – Home-based Observation Monitoring Exposure
HEPH – Hopi Environmental Health Project
ICP-MS – Inductively Coupled Mass Spectrometry
ICP-OES – Inductively Coupled Optical Emission Spectroscopy
ISES – International Society of Exposure Sciences
JHU – The Johns Hopkins University
MADRES – Maternal and Developmental Risks from Environmental and Social Stressors
NAU – Northern Arizona University
NCER – National Center for Environmental Research
NDVI – Normalized Difference Vegetation Index
NIEHS – National Institute of Environmental Health Sciences

NIH – National Institutes of Health

NIMHD – National Institute on Minority Health and Health Disparities

NO – Nitrogen Oxide

NO_2 – Nitrogen Dioxide

ORD – Office of Research and Development

PEPH – Partnerships for Environmental Public Health

PM – Particulate Matter

ROS – Reactive Oxygen Species

SD – Standard Deviation

SHC – Sustainable and Healthy Communities

STAR – Science To Achieve Results

UA – University of Arizona

UNM – University of New Mexico

USC – University of Southern California

U.S. EPA – U.S. Environmental Protection Agency

UVR – Ultraviolet Radiation

Introduction and Background

In 2014, the U.S. Environmental Protection Agency (EPA) and the National Institutes of Health (NIH) issued a joint solicitation to establish the NIH-EPA Centers of Excellence on Environmental Health Disparities (EHD Centers). From this solicitation, EPA, the National Institute on Minority Health and Health Disparities (NIMHD), and the National Institute of Environmental Health Sciences (NIEHS), competitively awarded five EHD Centers for funding from 2015 to 2020. Table 1 describes the general research areas and science questions addressed by the EHD Centers. Figure 1 depicts the center geographic locations, while Table 2 provides more specific details regarding each center's title, institution, director names, and specific areas of research focus. In addition, the centers employ a heavy community engagement focus to better understand environmental health concerns and to improve environmental conditions for vulnerable populations. For more information on the EHD Centers, visit www.epa.gov/research-grants/health-research-grants.

This report summarizes the second annual grantees meeting of the EHD Centers held on Dec. 4-5, 2017, in Albuquerque, NM. The meeting was hosted by the University of New Mexico (UNM) Center for Native American Environmental Health Equity Research (CNAEHER). Approximately 100 researchers, trainees, students, and community partners attended the meeting. In addition to research updates by the five EHD Centers, the meeting featured working group discussions around topics such as research translation, cross-center collaborations, and data harmonization. The meeting also included an interactive poster session, with 24 posters submitted by center researchers and students. Poster awards distributed in the following five contest categories. The contest winners are identified among the poster abstracts included in Appendix C.

1. Best acknowledgement of community input

The poster that best acknowledges the community involvement in the center activities and that recognizes the inherent value of the community partnerships and their impact on the center's successes.

2. Best acknowledgement of junior faculty & trainees

The poster that does the best job of recognizing junior faculty, students and trainees, and that acknowledges the value of their contribution to the accomplishments of the center.

3. Best use of graphics

The poster that best recognizes the value of visual communications and that uses various types of visual images to convey the information.

4. Most judicious use of text boxes

The poster that best summarizes information in a succinct but informative manner, and does not include long text boxes.

5. Most judicious use of bullet points

The poster that best uses bullet points instead of long text explanations to summarize methods, data and outcomes.

Table 1: EHD Centers Research Areas

Cumulative Effects of Multi-Environmental, Physical, and Social Stressors. How do the cumulative effects of multiple environmental contaminants combine with the effects of social stressors to affect health? What is the role of genetics and epigenetics in relation to chemical and non-chemical stressors?

Differential Exposures. How are different socioeconomic groups exposed differentially to environmental hazards and what are the drivers for such exposure scenarios?

Land Use Considerations and Health Disparities. How do different land use and land use decision-making processes contribute to environmental health disparities? What approaches can communities take to reduce these impacts?

Built Environment, Housing, and Transportation. How does proximity to transportation infrastructure affect the levels and types of exposures? How does poverty contribute to indoor and outdoor air pollution in residential settings?

Environmental Sustainability and Health Disparities. How do sustainable approaches reduce disproportionate health burdens and build community resilience? How will improvements in environmental health literacy enable a sustainable lifestyle?

Engagement of Affected Community Members and Organizations in Research. How can researchers provide culturally sensitive translation of findings to stakeholders, promote engagement with community members, and build capacity in environmental health awareness and understanding literacy and to foster strategies for risk prevention?

EHD Centers Locations and Descriptions

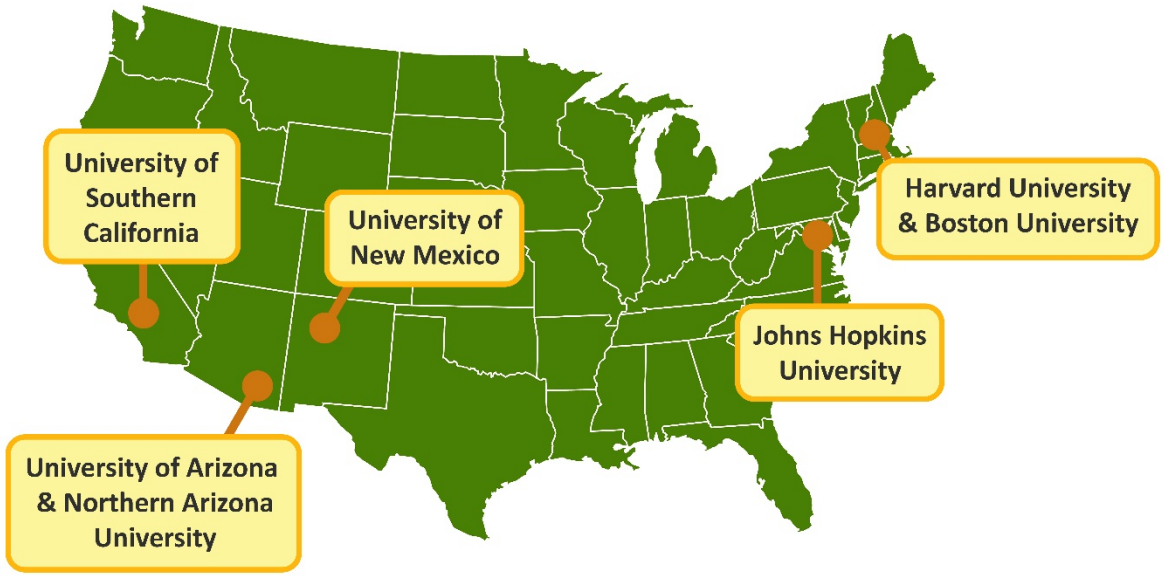

Figure 1: Map of the EHD Centers

Table 2: NIH-EPA Centers of Excellence on Environmental Health Disparities			
Center Title	**Directors**	**Institution(s)**	**Research Focus**
Center for Research on Environmental and Social Stressors in Housing across the Life Course (CRESSH)	Francine Laden; Jonathan Levy	Harvard University; Boston University	The accumulation of multiple environmental stressors across the life course and possible benefits from improved urban housing within low-income communities in Massachusetts.
Comparing Urban and Rural Effects of Poverty on COPD (CURE COPD) Center	Nadia Hansel	The Johns Hopkins University (JHU)	The urban and rural effects of poverty on chronic obstructive pulmonary disease (COPD), and the impact of improved diet on preventing or mitigating disease progression.
Center for Native American Environmental Health Equity Research (CNAEHER)	Johnnye Lewis; Melissa Gonzalez	University of New Mexico (UNM)	The effects of metal mixtures from abandoned mines on rural Native American populations with inadequate drinking water infrastructure.
Center for Indigenous Environmental Health Research (CIEHR)	Jeff Burgess	University of Arizona (UA); Northern Arizona University (NAU)	The chemical contamination of traditional foods, water, air, and household environments, and increasing environmental health literacy within indigenous populations.
Maternal and Developmental Risks from Environmental and Social Stressors (MADRES) Center	Frank Gilliland; Carrie Breton	University of Southern California (USC)	The environmental factors that may contribute to childhood obesity and excessive weight gain during pregnancy in Hispanic/Latino communities.

Since the UNM and UA/NAU EHD Centers specifically focus on addressing tribal environmental health issues, the meeting was well attended by the tribal community members and research partners of those centers (including tribal elders, research investigators, and students), many of whom travelled long distances to present alongside the center researchers. In addition to center updates, poster session, and working group discussions, the community partners also held a listening session to share their experiences working with the EHD Centers. They provided positive feedback and identified areas for improvement moving forward.

EHD Centers Annual Grantees Meetings

EPA and NIH representatives hold annual meetings for the EHD Center grantees to report research progress and developments. The lead for organizing these meetings rotates annually among the partner agencies. NIEHS organized the first meeting in 2016 in Durham, NC. NIEHS held the meeting during the Environmental Health Science FEST, a 50th anniversary celebration that brought together researchers, trainees, young investigators, community partners, and stakeholders from across the U.S. to discuss past accomplishments and explore the future of environmental health science in the 21st century. EPA organized the second annual meeting in 2017, which is the subject of this summary report. NIMHD will organize the 2018 meeting, which will likely take place in the Washington, D.C., area. Table 3 provides a schedule of the EHD Center grantees meetings through 2020.

Table 3: Schedule of EHD Centers Annual Grantee Meeting Hosts	
Meeting Year	*Federal Partner Lead and Host*
2016	NIEHS (hosted in conjunction with the NIEHS Environmental Health Science 50th Anniversary FEST)
2017	EPA (hosted by the CNAEHER at the University of New Mexico)
2018	NIMHD (hosted by the CURE COPD Center at The Johns Hopkins University)
2019	NIEHS
2020	EHD Centers Final Technical Reports Due

Meeting Agenda

Day One: Monday, Dec. 4, 2017

12:30 p.m. – 1:30 p.m. **Registration and Poster Set-Up**

1:30 p.m. – 2:00 p.m. **Welcome and Setting the Stage**

David Begay, Research Associate Professor, University of New Mexico

Maggie Breville, Research Program Manager, Water, Health, and Innovation Division, U.S. Environmental Protection Agency (EPA)

Sylvana Li, Director, Water, Health, and Innovation Division, EPA

Michael Sayre, Branch Chief, Integrative Biological and Behavioral Sciences, Division of Scientific Programs, National Institute on Minority Health and Health Disparities (NIMHD)

Gwen Collman, Director, Division of Extramural Research and Training, National Institute of Environmental Health Sciences (NIEHS)

2:00 p.m. – 4:15 p.m. **Center Updates**

2:00 p.m. – 3:00 p.m. Center for Native American Environmental Health Equity Research (CNAEHER), University of New Mexico

3:00 p.m. – 3:15 p.m. Break

3:15 p.m. – 4:15 p.m. Maternal and Developmental Risks from Environmental and Social Stressors (MADRES) Center, University of Southern California

4:15 p.m. – 4:30 p.m. **Day 1 Wrap-Up**

4:30 p.m. – 5:30 p.m. **Poster Session and Networking Hour**

6:00 p.m. **Group Dinner (optional)**

Day Two: Tuesday, Dec. 5, 2017

8:00 a.m. – 8:30 a.m. **Registration**

8:30 a.m. – 8:45 a.m. **Welcome and Overview**

8:45 a.m. – 12:15 p.m. **Center Updates**

8:45 a.m. – 9:45 a.m. Center for Research on Environmental and Social Stressors in Housing across the Life Course (CRESSH), Harvard University and Boston University

9:45 a.m. – 10:00 a.m. Break

10:00 a.m. – 11:00 a.m. Center for Indigenous Environmental Health Research (CIEHR), University of Arizona and Northern Arizona University

11:00 a.m. – 12:00 p.m. Comparing Urban and Rural Effects of Poverty on COPD Center (CURE COPD Center), The Johns Hopkins University

12:00 p.m. – 1:00 p.m. **Lunch**

1:00 p.m. – 1:30 p.m. **Poster Session and Announcement of Poster Prize Winners**

1:30 p.m. – 3:00 p.m. **Working Group Discussions**

- Research Translation
- Cross-Center Collaborative Publications
- Data Harmonization
- Community Partner Feedback (Closed Session)

3:00 p.m. – 3:15 p.m. **Break**

3:15 p.m. – 4:00 p.m. **Working Group Report-Back and Discussion**

4:00 p.m. – 4:45 p.m. **Listening Session – Community Partner Feedback**

4:45 p.m. – 5:00 p.m. **Meeting Wrap-Up and Closing Remarks**

5:00 p.m. **Adjourn**

Meeting Summary

Day One: Monday, Dec. 4, 2017

Welcome and Overview

Maggie Breville, M.S.

Research Program Manager, Water, Health, and Innovation Division, NCER, ORD, EPA

The second annual grantees meeting of the EHD Centers began with welcoming remarks and introductions by Ms. Maggie Breville, the EHD Centers program manager for EPA. She thanked everyone for coming and informed the audience that the meeting was being webcasted. She also thanked Drs. Johnnye Lewis and Melissa Gonzales at the CNAEHER for hosting the meeting and securing accommodations at the beautiful UNM Comprehensive Cancer Center building.

Ms. Breville also thanked specific UNM staff for their hard work and assistance with coordinating and organizing the grantees meeting, including Kelley Maez, Administrative Coordinator of Community Relations and Special Events at the Cancer Center; Carol (CJ) Laselute, Administrative Assistant at the UNM Health Science Center; and Jose Lucero, Technical Analyst with the Cancer Center Information Services. She then welcomed the EHD Centers, their community partners, and their students and staff, and thanked them for attending the meeting. She extended special thanks on behalf of the NIMHD, EPA, and NIEHS federal partners to the UNM center staff for hosting the meeting. Ms. Breville then introduced Dr. David Begay, who welcomed the meeting participants on behalf of UNM. Dr. Begay is a Research Associate Professor at UNM and a Cultural Consultant to many organizations and corporations both in the U.S. and internationally.

David Begay, Ph.D.

Research Associate Professor, Community Environmental Health Program, College of Pharmacy, UNM

Dr. Begay greeted the audience by saying "hello" in his native Navajo language, where people say "Yá'át'ééh," which he explained originally has a unique meaning: "Yá" refers to the universe; and "át'ééh" refers to the existence of the human participants of the universe, including the earth, which is a mere participant of the much bigger universe. Therefore, the greeting is an acknowledgement of the individual, the earth, and the universe within which we are all participants.

Dr. Begay stated that he is a member of the Navajo Nation, with ancestral linkage to the Jemez Pueblo people. He remarked that there are many Native communities in New Mexico, especially along the Rio Grande River. Toward the south (where he has lots of friends) there's the San Ildefonso, Santa Ana, Sandia, Santo Domingo, going all the way up to Taos. To the north and west of Navajo Nation, there is the Ute and the Paiute communities. Toward the south, there's the San Carlos, Jicarilla, Mescalero and other Apache communities, as well as others in Tucson, Arizona. These areas are all known as Indian Country. He welcomed everyone from all walks of life. Lastly, he acknowledged and gave thanks to the Native community partners from Arizona and other far away Tribal lands who made the long drive to attend this meeting, giving recognition to the time, commitment, and resources they've expended to be there.

Ms. Breville thanked Dr. Begay for his welcoming remarks. She then introduced the coordinating Federal partners that manage the NIH-EPA EHD Centers. She noted that at EPA, the centers are supported within the National Center for Environmental Research (NCER) in the Office of Research and Development (ORD), and through the Sustainable and Health Communities Research (SHC) program. At NIMHD, the EHD Centers are directed by Dr. Nishadi Rajapakse, who is a Program Director in the Division of Scientific Programs. At the NIEHS, they are directed by Dr. Symma Finn. She is a Health Science Administrator in the Population Health Branch of the Division of Extramural Research and Training. Also at NIEHS, Mr. Liam O'Fallon oversees the Community Engagement Cores of the EHD centers. Mr. O'Fallon is a Health Scientist in the same branch and division, and works closely with Dr. Finn. Ms. Breville explained that together, this is the team of "worker bees" that keep the wheels of the EHD Centers churning. She then introduced the leadership at the Federal partnership, who provided their welcoming remarks.

Welcoming Remarks from the Federal Partner Leaders

Sylvana Li, Ph.D.

Division Director, Water, Health, and Innovation Division, ORD, EPA

Dr. Li remarked how proud NCER is of the EHD Centers and the collaborative efforts to focus on this very important research topic. She discussed the goals of EPA's new Strategic Plan for Fiscal Year 2018-2022. She explained these goals are designed to refocus the way the Agency does business. They guide EPA's role of supporting the primary implementers of environmental programs—states and tribes—by streamlining programs and processes, reducing duplication of effort, and providing greater transparency and listening opportunities. The draft Strategic Plan was posted in the Federal Register for public comment this past October, and the Agency hopes to finalize the plan in early 2018. (The final plan is now available on the EPA website.)

Dr. Li remarked that the current EHD Centers are building upon the research of former pilot Centers of Excellence on Environment and Health Disparities that were established in 2012 in partnership with NIMHD. These pilot centers are now closed, and a report that summarizes their impacts and accomplishments is available online. She also noted that the meeting proceedings will be captured in an EPA report, currently targeted a product deliverable for Fiscal Year 2018, and will also be available on the EPA website. Dr. Li concluded her remarks by stating that EPA is very excited for this opportunity to welcome the EHD Center investigators, researchers, community partners, students, and staff. She said she is looking forward to learning, networking, and exchanging knowledge fostered by these great centers.

Michael Sayre, Ph.D.

Branch Chief, Integrative Biological and Behavioral Sciences, Division of Scientific Programs, NIMHD, NIH

Dr. Sayre joined the meeting remotely. He stated that on behalf of Dr. Eliseo J. Perez-Stable, NIMHD Director, he wanted to thank the audience for gathering and for sharing the exciting progress of the EHD Centers. He remarked that NIMHD is very excited about the ongoing collaborations with EPA and NIEHS, stating that this collaboration has gone on for many years, starting with the pilot EHD Centers. He stated that it was especially gratifying to see that this unique and ambitious program growing and coming to fruition in the way that it has. He gave special thanks and recognition to the five center directors, their

staff, and their colleagues for organizing this meeting. He remarked on how exciting it is to see publications starting to emerge from the centers, and that NIMHD is looking forward to hearing about some great science over the next day and half.

Gwen Collman, Ph.D.

Director, Division of Extramural Research and Training, NIEHS, NIH

Dr. Collman joined the meeting remotely. She joined the other members of leadership from the partnership agencies, first in thanking the leadership at those agencies for working together on this important program, and to the program's grants management and review staff who have been instrumental in making this program work. She congratulated the principal investigators, co-investigators, research partners, and community partners of the five centers across the country. She stated that the work they're doing is vitally important and that environmental health disparities is a long-standing interest for NIEHS and the other agencies.

More specifically, Dr. Collman explained that NIEHS got into the research business of environmental justice close to 20 years ago, and have developed many programs over the years that focus on vulnerable populations, health disparities, and engage communities in that research. They have also focused on engaging directly with those communities to give them a voice in so many of the programs that NIEHS supports. In addition to the environmental health disparities work with the partner agencies, NIEHS has developed many programs that have community engagement components, research cores, and research translation. They have also developed specific funding programs that require the fundamental research be appropriately translated so that the beauty of the work can be communicated to stakeholders. This is, all within the guise of improving public health, improving awareness, and raising environmental health literacy. That part of the strategy at NIEHS is called the Partnerships for Environmental Public Health (PEPH) Program, which many know is an umbrella program for all NIEHS initiatives that engage communities. PEPH has a newsletter that goes out by email to several thousand recipients. There's also a resource center, webinars, and other meetings that offers opportunities for people to get involved. Dr. Collman heartily welcomed participants to engage as fully as possible in this program.

Dr. Collman then highlighted another available program for the research community and environmental health disparities area, the NIEHS advisory council, which is an active body that meets three times per year to discuss science, funding strategies, initiatives, and gives previews to the scientific communities about future funding opportunities and identifies important areas for dialogue with the NIEHS council members. She brought this to the attendees' attention because the open sessions of the council meetings are webcasted, and she encouraged then to visit the website for the upcoming February, May, and September meetings, to view the agendas, get on the webcast to listen to staff present new ideas and concepts. They could also listen to the deliberations of the advisors as they discuss these initiatives and how the institute can support and stimulate so many areas, that would be quite important to the work of the EHD centers. She noted that some of those ideas are not just research ideas, but may also include training and capacity building concepts.

Dr. Collman remarked that in reviewing the program material for this meeting, she noticed that over a third of the poster abstracts come from graduate students at every level: post-baccalaureate, masters, doctoral, and post-doctoral. She congratulated all for bringing in so many gifted students into their programs and highlighting their work at this annual meeting. She also acknowledged that the group has collaborated to put on sessions at the International Society of Exposure Science (ISES) and the American Public Health Association (APHA), and NIEHS is pleased to see this type of work go forward into the

communities. She remarked on meeting several students from the program at the ISES meeting that was held in RTP at their posters, talking about their experiences, and how it is an amazing thing for her as a Director of the program to see the next generation being so engaged, so well trained, and so excited about the work.

Following Dr. Li's mention of the EPA Strategic Plan, Dr. Collman also remarked that the NIEHS Strategic Plan was developed about four years ago with a focus on health disparities, and that this program was one of the identified outputs that would have a lot of impact. She stated that NIEHS is recrafting their strategic plan for the next five years, and have asked for feedback from the community on what went well and where they think new opportunities are as they are refashioning the next five-year version. The presentation analogous with the next plan will be posted on the NIEHS website at the end of January 2018 and there'll be a presentation and discussion at their council's February meeting. She encourages all the meeting participants to listen and provide their feedback to the next phase of the plan. She noted that NIEHS really wants to hear from their researchers and community members about the direction that NIEHS will be taking in the future.

The last point Dr. Collman wanted to raise is that NIEHS is always looking for committed community members: people who are involved with the environmental justice community and care about environmental health disparities at the community level; to serve as public members on the NIEHS advisory council. It is sometimes more difficult to identify these members, and therefore she is reaching out to participant of this meeting. She welcomes email suggestions for people who may be interested in serving in this capacity. She stated that it would be very valuable for NIEHS to make new connections with community members across the country, and similarly, she is hoping that it would also be a good experience for the members to participate on their advisory group. With that, she wished the group a fantastic meeting and expressed her regrets for not being able to be with them in person this time. However, she is confident that her staff is present and can address any questions that may arise. She also invited the meeting participants to email her with anything they wished to share or discuss with her about this meeting.

Center Updates

Following the opening remarks and introductions, the centers presented updates and research findings from the previous year, as well as the next steps for their research projects. Following each presentation, there was time for audience questions and discussion. Two centers presented on Day 1 of the meeting, and the remaining three centers presented on Day 2.

Center for Native American Environmental Health Equity Research (CNAEHER)

University of New Mexico

Presenters: Johnnye Lewis, Ph.D., Melissa Gonzales, Ph.D., Laurie Hudson, Ph.D., Debra MacKenzie, Ph.D., Joseph Hoover, Ph.D., and Jose Cerrato, Ph.D.

Presentation Summary:
Dr. Lewis introduced the presentation by saying that the center is a partnership with multiple tribes and tribal communities, including Cheyenne River Sioux, Crow, and Navajo. The center was started to address potential health effects of exposures to metal mixtures from abandoned hard rock mines in the southeastern U.S. As many Native American reservations are located within close proximity to these mines, tribal communities may be at increased risk. The metals of concern found in mining waste include uranium, arsenic, mercury, and manganese. Dr. Lewis emphasized that center researchers are working with community partners to identify, quantify, and interpret potential exposures of concern based on community practices. They have collected blood and urine samples, and are analyzing them to determine levels of recent exposure, levels of DNA damage and repair based on molecular markers, and exposure-related changes in the immune system. Researchers also use animal and molecular models to better understand cause-effect relationships between the observed metal mixture exposures and health outcomes.

Project 1: Metals and Metal Mixtures in DNA Damage and Repair

Presentation Summary

Dr. Hudson explained that the focus of Project 1 is to assess levels of recent environmental exposures and markers of DNA damage and repair. Health effects related to metal exposure include cancer, neurotoxicity, kidney disease, lung disease, heart disease, immune disorders, and skin disorders. This study focuses on cancer and immune disorders. To understand disease, researchers aim to understand how metals cause damage to cells.

Significant Results

One of the ways that metals can cause damage to cells is by interfering with DNA repair proteins that protect DNA integrity. Researchers found that when toxic metals are introduced, certain DNA repair proteins lose zinc which is responsible for protein function. Arsenic is more potent than uranium for inhibition of DNA repair and cell toxicity. However, when zinc is introduced in the presence of metals, it can restore the function of the DNA repair proteins, counteracting the effects of toxic metals and decrease DNA damage caused by toxic metals.

Next Steps

With the community partners, researchers hope to analyze diet for zinc deficiency and improve nutrition in ways that can assist in DNA repair.

Project 2: Immune Dysregulation and Biomarkers of Autoimmunity in Tribal Communities Exposed to Mixed Metal Contaminants

Presentation Summary
Dr. MacKenzie explained that the focus of Project 2 is understanding exposure-related changes to the immune system. The project is driven by both clinician and community concerns about the increase in autoimmune disorders in individuals living in proximity to toxic mine waste. The center aims to understand if presence of metal in the body shifts the immune system out of balance. Researchers collect blood and urine samples to measure levels of metals. Researchers are also using animal models to validate these results. They are also examining the prevalence and specificity of autoantibodies, changes in cellular phenotypes, and changes in cellular messengers.

Significant Results
Results from a Navajo birth cohort study show increases in prevalence of biomarkers of autoimmunity. In males, the levels of antinuclear antibodies (ANA) were associated with increased urine uranium levels. Results also show increases in specificity in biomarkers of autoimmunity. A study of the Cheyenne River Sioux Tribe showed elevated antibody reactivity to denatured DNA. This pattern is associated with the diagnosis of Lupus. Researchers also found that immune cell populations are affected by metal exposures. In a Navajo population, there are significant associations between mercury, manganese, cadmium, uranium, and arsenic with changes in immune cell populations. Protein messengers (cytokines) produced by immune cells are also affected by metal exposure. For example, in a Navajo community, elevations in immunologic mediators were associated with increased urine uranium levels. Altered cytokine expression could result in immune dysregulation.

Next Steps
Researchers will continue data collection and analysis. They will also further explore the effects of mixed metals on immune function. A pilot animal study will also explore the effect of *in utero* exposures on immunologic outcomes.

Community Engagement and Translation Core (CETC)
Presentation Summary
Dr. Cerrato described the goal of the CETC, which is to work with community partners to identify, quantify, and interpret potential exposures of concern based on community practices.

Significant Results
The center has an 'artist in residence', who illustrates mechanisms of toxicity in DNA damage and repair. The illustrations are in response to community requests for research translation in alternative forms.

Next Steps
Researchers will continue to build capacity with community partners. They will also begin a project to restore natural vegetation and native plants along rivers.

Environmental Monitoring and Interpretation Core (EMIC)
Presentation Summary
Dr. Hoover discussed examples of exposure-related work developed in response to community concerns and requests. One example was an inhalation exposure scenario, where researchers modeled arsenic exposure for participants in a representative traditional ceremony. The EMIC is also measuring bacterial contamination in private wells on Native American reservations.

Significant Results
The EMIC has provided training to students on field sampling protocols and rationale. One example of a student trainee project was to measure arsenic in sediments of the Cheyenne River. The EMIC has also validated analyses of water quality samples for the Crow Water Quality Project, and validated a UNM protocol to analyze urine samples based on accepted protocol. In response to partners on Navajo Nation who were concerned about effects of the Gold King Mine Spill, the EMIC did some additional studies on water quality. They identified a series of biochemical processes influencing sediment-metal mobility among the Animas River.

Next Steps
A project in development will track movement of livestock and their exposure to abandoned uranium mine waste in the Cove Wash watershed. Researchers will track the livestock via GPS, collect tissue samples, and assess risk to human health.

For a copy of the CNAEHER meeting presentation slides, contact Dr. Johnnye Lewis at jlewis@cybermesa.com or Dr. Melissa Gonzales at MGonzlaes@salud.unm.edu.

Maternal and Developmental Risks from Environmental and Social Stressors (MADRES) Center

University of Southern California

Presenters: Frank Gilliland, M.D., Ph.D., M.P.H., Carrie Breton, Sc.D., Tracy Bastain, Ph.D., M.P.H., Rima Habre, Sc.D., Genevieve Dunton, Ph.D., M.P.H., and Jill Johnston, Ph.D.

Presentation Summary:
Dr. Breton introduced the primary goal of the MADRES Center, which is to understand causes of underlying health disparities in childhood obesity and excessive weight gain and postpartum weight retention among minority and low-income women in Los Angeles. She also discussed the center structure, which includes two projects, a community engagement core, a population core, an exposure core, and an administrative core.

Population Core

Presentation Summary

Dr. Bastain explained that the Population Core is responsible for enrolling people in to the pregnancy cohort, and maintain the study cohort as a data resource. They facilitate recruitment and data collection efforts for both Project 1 and Project 2. To recruit participants, researchers partner with women's health and family medicine community health clinics dedicated to underserved populations in urban Los Angeles. The Population Core aims to enroll a total of 750 mother-infant pairs.

Significant Results

The Population Core has enrolled 245 pregnant women, and continues to collect health information. Dr. Bastain discussed some challenges to recruitment.

Next Steps

The Population Core will continue to enroll pregnant women, and aim to have 400 women enrolled by June 2018.

Exposure Core

Presentation Summary

Dr. Habre discussed the goal of the Exposure Core, which is to provide an efficient approach to the use of cutting edge exposure assessment tools and methods across the center.

Significant Results

Researchers have assigned all participant a CalEnviroScreen score to identify those most burdened by multiple sources of pollution and those especially vulnerable to environmental effects. The score includes pollution burden and population characteristics. Maps of all participant scores show spatial variability across the Los Angeles region. For example, scores are higher for those living closer to major roadways. Researchers have also conducted spatial analysis of metals found in hair samples. Preliminary results show higher levels of lead in east Los Angeles, higher levels of vanadium near major roadways, and higher levels of molybdenum in areas with high traffic density.

Next Steps

The Exposure Core will assemble residential histories of participants, and assess regional air pollution levels. They will also assess social environmental stressors on the census tract level. Researchers will continue spatial analyses of metal exposures.

Project 1: Cumulative Prenatal and Infant Environmental Exposures and Early Childhood Obesity Risk

Presentation Summary

Dr. Breton explained that the goals are to determine how prenatal and infant exposures affect birth weight and 12-month childhood growth trajectories. They also want to determine if the relationship varies by maternal factors such as stress or pre-pregnancy obesity.

Significant Results

Researchers assessed 33 elements in hair samples from pregnant women in their first trimester. On average, arsenic levels were relatively low and manganese levels slightly higher in the sampled population. 111 babies have been born into this cohort to date.

Next Steps

Researchers will continue measuring exposures in pregnant women, and evaluating birth weight and growth of their babies. Fat distribution in babies will be assessed using EchoMRI.

Project 2: Environmental Exposures, Stress, and Maternal Pregnancy-Related Weight Outcomes

Presentation Summary

Dr. Dunton introduced the conceptual model for this project, which shows the social and environmental factors that influence pregnancy-related weight outcomes and long-term health outcomes. On days when environmental exposures may be higher, pregnant women may have psychological or behavioral responses such as stress and energy-balance behaviors that influence their short and long-term health. The project hypothesizes that greater personal environmental exposures and social stressors will be associated with greater perceived stress, sedentary activity, high-fat/high-sugar intake, lower physical activity, and lower fruit/vegetable/fiber intake. Researchers collect real-time ecological momentary assessments (EMA), salivary cortisol, and 24-hour diet recalls during the first and third trimesters, as well as six months postpartum. Researchers also collect GPS information and fine particulate matter ($PM_{2.5}$) from personal sampling devices.

Significant Results

Based on the EMAs, women experience the most stress from work at home. Cortisol concentrations show a spike first thing in the morning, then varying declining slopes based on stress levels.

Community Engagement Core (CEC)

Presentation Summary

Dr. Johnston introduced the organizations and agencies through which they aim to reach Latina mothers in Los Angeles, including health care and service agencies, public health departments, colleges, and community health workers. Researchers acknowledge that little is known about how pregnant women and new moms perceive environmental health, especially those impacted by health disparities. The CEC aims to assess the awareness of environmental hazards among Latina moms from environmentally burdened communities, including collecting information about whether this knowledge influences behaviors, examining potential barriers to taking protective actions, and informing the community engagement efforts. Researchers conducted semi-structured, interactive, in-depth interviews that highlight the voice of individuals in the community and characterize the community in complex fashion. The CEC aims to use the information presented in these interviews to build environmental health literacy. Researchers used green cleaning products as an entry point to discuss environmental exposures and health impacts. They also developed a program where members of the community can make their own cleaning products.

Significant Results
Some themes that emerged from the interviews were perceptions of adverse exposures, health impacts, household and neighborhood risks, and social and political issues. The women interviewed all expressed an interest in learning more about environmental risks to their health and pregnancy.

For a copy of the MADRES Center meeting presentation slides, contact Dr. Frank Gilliland at gillilan@usc.edu or Dr. Carrie Breton at breton@usc.edu.

Day Two: Tuesday, Dec. 5, 2017

Center Updates

Day 2 began with the three remaining centers presenting updates and research findings from the previous year, as well as next steps for their project. Following each presentation there was time for audience questions and discussion.

Center for Research on Environmental and Social Stressors in Housing across the Life Course (CRESSH)

Harvard University and Boston University

Presenters: Francine Laden, Sc.D., Patricia Fabian, Sc.D., Gary Adamkiewicz, Ph.D., and Claire Schollaert, B.A.

Presentation Summary: The CRESSH center is a joint project between the Harvard University and Boston University Schools of Public Health. The center focuses on highly integrated activities across Massachusetts and within two target communities. The research emphasizes the influence of housing and the neighborhood environment on multiple exposures and health outcomes. Dr. Laden introduced the structure of the center, which has three unique projects in addition to an administrative core, community engagement core, and pilot project program. The two target communities, Chelsea and Dorchester, both meet environmental justice criteria for minority, income, and linguistic isolation. Dr. Laden then highlighted some accomplishments of the administrative core, including meetings of the internal steering committee and external advisory board, engagement of early career investigators and trainees, and between-project integration. Next steps for the center include maximizing the reach of the center, communicating findings to various stakeholders, maintaining key attributes of the interdisciplinary center with spin-off grants, and envisioning the future of CRESSH beyond this grant cycle.

Project 1: CRESSH Health Effects Across the Lifecourse (HEAL)

Summary
The CRESSH HEAL study is the epidemiologic arm of the center, which pulls together information from Projects 2 and 3 and other resources to assess the effects of environmental exposures on cardiovascular mortality, birth outcomes, and child growth. The specific aims of this study are (1) develop innovative methods to estimate health effects associated with multiple chemical stressors, (2) estimate the complex interactions of exposures to multiple chemical and non-chemical stressors on birth outcomes, growth rates, and cardiovascular mortality, and (3) identify epigenetic profiles associated with air pollution exposures and non-chemical stressors that modify health outcomes.

Significant Results

Recent and ongoing analyses within CRESSH HEAL include investigations of the effects of residential segregation and $PM_{2.5}$ on birth weight. CRESSH HEAL has also recently studied the effect of $PM_{2.5}$ on cardiovascular mortality rates, and if that relationship was modified by residential segregation and other non-chemical stressors. CRESSH HEAL also examined the effects of prenatal $PM_{2.5}$ exposures on child growth trajectories.

Next Steps

Researchers will continue creating and preparing merged data sets, including pollution and other variables. They will also continue to work with the community engagement core to communicate results.

Project 2: Home-based Observation and Monitoring Exposure (HOME)

Summary

Dr. Adamkiewicz introduced CRESSH HOME, which is the main exposure assessment arm of the center. The specific aims of this center are to (1) use portable, real-time monitoring devices to estimate indoor exposures to multiple chemical stressors, noise, and thermal comfort, and (2) determine how resident behaviors and housing characteristics affect indoor-outdoor associations of chemical and non-chemical stressors. The study is designed to conduct two seven-day in-home sampling sessions, over two seasons. Researchers administer a survey to participants, do a visual assessment of the home, and measure air pollution levels and temperature. Between 2016 and 2017, researchers recruited 72 households that mirror the overall demographics of Chelsea, along with 20 households in Dorchester.

Significant Results

Researchers measured the levels of nitrogen dioxide (NO_2) and other indoor air pollutants in summer and winter. Results show a large amount of variability in 7-day pollution levels between houses. This variability could come from ambient sources or differences in daily activity in each household. Households also showed variability in hour-by-hour pollution levels. For example, nitrogen oxide (NO) and NO_2 levels spiked during cooking activity in houses with gas stoves but not in houses with electric stoves.

Next Steps

Researchers will match data with survey and time activity data to test for associations with household characteristics and resident activities. Researchers will also continue to link data with Project 3 (MAP-EHD) analyses.

Project 3: Mapping Spatial Patterns in Environmental and Housing Disparities (MAP-EHD)

Summary

Dr. Fabian introduced CRESSH MAP-EHD, which is the cumulative risk assessment and disparities analysis arm of the center. The specific aims of this project are to (1) characterize disparities in exposure to chemical and non-chemical stressors across Massachusetts, (2) develop and evaluate multivariable chemical and non-chemical stressor constructs to better characterize exposures, and (3) develop models of cumulative risk for multiple health outcomes across the life course in two target communities. Researchers have brought together data from multiple sources, including public databases, geographical information systems (GIS) derived variables, remote sensing, and meteorology. Data from this project will be linked to CRESSH HEAL to evaluate the health benefits of reductions in specific risk factors.

Significant Results

Researchers conducted disparity analyses to investigate inequality in outdoor air pollution exposure across Massachusetts. Over time, air pollution concentrations have been decreasing, however the levels in urban areas are still higher than in rural areas. In urban areas, non-Hispanic whites have significantly lower exposures compared to Hispanics, African Americans, and non-Hispanic Asians. In addition, researchers extended the outdoor air pollution work by modeling residential air exchange rates and considering populations who have the highest indoor exposures to pollution of ambient origin. The results show that housing characteristics such as air exchange rate (AER) can increase variability in exposures and potentially exacerbate exposure inequalities.

Next Steps

Researchers will continue index validation with field data for sharing with Project 1.

Community Engagement Core (CEC)

Summary

Ms. Schollaert introduced the CRESSH CEC. The specific aims of the CEC are to (1) design, implement, and evaluate training for community residents to participate in research, (2) evaluate and inform MAP-EHD chemical and nonchemical stressor constructs, stressor exposure models, and microdata simulation constraint variables, and (3) develop culturally appropriate educational materials that translate the aims and findings of research from all projects to improve environmental health literacy while reducing risk. The CEC facilitates bi-directional engagement with community partners, including GreenRoots and Health Resources in Action. The community partners are heavily engaged in the participant recruitment process, development of resource materials and report-back methods, and field work training. The CRESSH CEC communicates results through mechanisms including (but not limited to) quarterly newsletters, the center website, and social media.

Next Steps

The CEC has multiple goals related to the report-back of HOME study results. Researchers, in collaboration with community partners, will continue activities to achieve these goals. Some of these activities include letters, data visualization, and community meetings.

For a copy of the CRESSH meeting presentation slides, contact Dr. Francine Laden at francine.laden@channing.harvard.edu or Dr. Jonathan Levy at jonlevy@bu.edu.

Center for Indigenous Environmental Health Research (CIEHR)

University of Arizona and Northern Arizona University

Presenters: Jeff Burgess, M.D., M.P.H., Jani Ingram, Ph.D., Robin Harris, Ph.D., Paloma Beamer, Ph.D., Karletta Chief, Ph.D., Brian Mayer, Ph.D., Michael Lerma, Ph.D., Nicolette Teufel-Shone, Ph.D., Nicole Yuan, Ph.D., Duane "Chili" Yazzie, Mae-Gilene Begay, M.S.W., Brenette Pine, and Janene Yazzie

Presentation Summary: The CIEHR center is a partnership with indigenous communities that focuses on environmental health inequities and builds capacity of community partners to address environmental contaminants of concern. Specifically, the center is focusing on air quality, water quality, foods, and traditional practices that may face environmental threats. The center aims to increase environmental health literacy and improve conditions that results in environmental health disparities for indigenous communities. Dr. Burgess introduced the CIEHR structure, including three projects, an exposure science core, a community engagement core, and an administrative core. Dr. Burgess emphasized that the research is community-driven.

Cumulative Environmental Effects: Expanding Research with the Hopi Tribe

Presentation Summary

Dr. Harris introduced the Hopi Environmental Health Project (HEHP) and introduced the co-investigators and Hopi community partners. She then described the Hopi lands in northern Arizona. Some concerns of the tribal community included high rates of asthma and other chronic diseases, and specific concerns about air pollution, arsenic, and uranium. The long-range goals of HEHP are to determine the magnitude of exposures to environmental agents (inside and outside the home) and to evaluate their relationship to disease. The specific aims are to (1) characterize the magnitude of PM, arsenic, uranium, and other contaminants from air, water, and food in households among the Hopi, (2) evaluate how exposures are moderated by social determinants of health, social capital, and community resilience, and (3) expand the Hopi Tribe's capacity to address areas of environmental concern that can inform programs and policy. The project developed a community action board (CAB) to provide community perspective, vet procedures and instruments to be used in the community, address additional concerns of the community, and to provide oversight assuring that results reach participants and tribal members. The CAB, consisting of 8-12 Hopi community members and professionals, meets regularly to evaluate all parts of the project.

Significant Results

Researchers installed an air monitoring station near the Hopi Mission School. Initial results from the air monitoring station show pollution levels lower than what you would see in urban areas, however the levels change seasonally and temporally. Researchers also conducted focus groups to evaluate risk perception and social determinants of health. Dr. Mayer reviewed results from the focus groups, which show that Hopi community members self-identify with beliefs and ceremonial practices of the tribe. Challenges to Hopi resilience include degradation of traditional practices and communal structures, such as declines in youth participation in farming, and shifts away from collective decision-making. Members of the focus group expressed interest in investing and educating the youth about environmental stewardship to improve the social-ecological relationships of the future. Researchers also conducted household surveys during heating and non-heating months of the year. Houses were selected based on three structures: modern, manufactured/mobile, and traditional. Before administering the survey, researchers hosted a project introduction community fair to introduce themselves and explain their goals

to the community. So far, the project has surveyed 21 individual homes, nine homes in both the heating and non-heating seasons. Preliminary results show that $PM_{2.5}$ levels inside the home varies by season and by heating type. Results also show that in general, AERs are low because Hopi homes are built to keep heat in winter. However, the manufactured/mobile homes have the highest AER.

Next Steps
Researchers will continue to sample air quality and administer home surveys.

Health and Wellbeing Impact of Contamination on Traditional Food on Navajo
Presentation Summary
Dr. Ingram introduced the overall goals of this project. The specific aims are to (1) characterize the extent of metal contamination in culturally significant food and water sources for two Navajo communities, (2) model dietary metal exposure and utilize the Indigenous Health Indicator to assess health impact, and (3) develop a community-based participatory multi-level policy intervention model.

Significant Results
In support of the first aim, researchers worked with Navajo community members to collect sheep samples from Cameron and Leupp. Results show that the average contamination of uranium in sheep kidney were similar in both communities, despite Leupp not being a site of uranium mining. In support of the second aim, researchers administered a survey to determine the consumption of sheep and gain insight into the cultural significance of sheep to the community. Data analysis for this aim is ongoing. In support of the third aim, researchers are working with tribal Elders to form policy on contaminated traditional food. Dr. Lerma described meetings with these Elders to gain insight into Navajo Fundamental Laws. The goal is to develop guidelines for sheep consumption in the Navajo community.

Next Steps
Researchers will investigate other analytes in sheep samples, including iron, lead, sulfur, manganese, selenium, and nickel. Researchers will continue analyzing data and communicate results to the Navajo community.

Gold King Mine Spill: Diné Exposure Project
Presentation Summary
Mr. Yazzie began by describing the impact of the Spill on the Navajo community, including on agriculture and water sources. Dr. Beamer then introduced the specific aims, which are to (1) determine differences in exposure between three Navajo chapters downstream of Gold King Mine (GKM), (2) assess temporal and spatial changes in sediment, agricultural soil, irrigation water, and river, and (3) determine association between Navajo perception of health risks and measured health risks. Researchers evaluated the concentration of metals (iron, lead, zinc, copper, arsenic, and cadmium) in Cement Creek in August 2015, and identified that lead and arsenic were the main contaminants of concern.

Significant Results
In support of the first aim, researchers administered a questionnaire and food recall survey, and collected drinking water, dust, soil, blood, and urine samples. They then tested blood lead levels in adults and children, and reported these results back to the community. Results showed that lead in blood, drinking water, soil, and house dust were within normal limits. Arsenic in drinking water, soil, and house dust were

also within normal limits. Researches did find that urinary arsenic levels were slightly higher than the U.S. average. Based on the questionnaire, researchers learned that activities related to livelihood, recreation, and culture were all affected by the Spill. In support of the second aim, researchers collected (within one year of the Spill) environmental samples from river water, river sediment, agricultural soil, irrigation water, and irrigation sediment in winter, spring, and summer. In support of the third aim, researchers conducted focus groups to understand the risk perception from the GKM Spill. The focus groups were conducted in Diné kéji (Navajo language) and translated to English. Researchers identified top themes of perceived risks and changed behaviors as a result of the Spill. The top themes include health risk, distrust, cultural risk, farming changes, environmental risk, financial risk, and mental health changes, among others.

Next Steps
Researchers will continue to work with the community to communicate results.

Community Engagement Core (CEC)
Presentation Summary
Dr. Teufel-Shone introduced the specific aims of the CEC, which are to (1) oversee the translation and dissemination of knowledge obtained from research on environmental health exposures, and (2) collaborate with American Indian and Alaskan Native (AI/AN) communities to develop culturally-relevant policies and assets-based programs that reinforce resilience to mitigate adverse health effects. The CEC uses principles of community-based participatory research to inform their goals.

Significant Results
The CEC is integrated into all projects of CIEHR. For example, they assisted with the sheep consumption questionnaire for the Navajo project, supported training in the Gold King Mine impact project, and assisted in developing educational strategies with the CIEHR pilot projects. The CEC is currently evaluating the effectiveness of their activities and the impact of their contributions to the mission of the center. The CEC was also instrumental in developing the CAB guidelines which address three stages: formation, operation and maintenance, and sustainability and evaluation. They presented these guidelines to the American Public Health Association and are preparing a manuscript which describes the process.

Next Steps
The CEC will continue pilot testing the guidelines and disseminating the final document. They will also work with CIEHR research teams to develop effective means to provide education and disseminate research results. The CEC will continue to collaborate with pilot projects, and participate in center-wide discussions to develop an instrument to track changes in community resilience.

For a copy of the CIEHR meeting presentation slides, contact Ms. Rachelle Begay at rlbegay@email.arizona.edu.

Comparing Urban and Rural Effects of Poverty on COPD (CURE COPD) Center

The Johns Hopkins University

Presenters: Nadia Hansel, M.D., Panagis Galiatsatos, M.D., Meredith McCormack, and M.D., Mildred Maisonet, Ph.D.

Presentation Summary:

Dr. Hansel introduced the presentation and the health burden of COPD, which is the third leading cause of death in the U.S. The greatest risk factor in the U.S. is smoking, but other environmental factors also contribute to the development and severity of COPD. The CURE COPD Center focuses on indoor air quality and the effects on COPD morbidity. The burden of indoor air pollutants such as $PM_{2.5}$ is higher in low-income households, as seen in Baltimore, MD. Since people spend most of their time in their homes, exposure levels can be very high. Dr. Hansel points out that rates of obesity are also rising in the U.S., and presents a higher burden in low-income communities. Analyses show that obesity may increase susceptibility to PM in those with COPD. The CURE COPD Center social stressors, including obesity and diet, may modify the impact of PM on COPD symptoms. Dr. Hansel then explained the structure of the center, which includes two projects, a data core, an environmental core, and a community outreach core. Project 1 investigates the relationship between obesity, air pollution, and COPD in urban Baltimore, while Project 2 investigates this same relationship in rural Appalachia.

Project 1: Obesity and Adverse Dietary Patterns as Susceptibility Factors to Pollutant Exposure in Urban COPD

Presentation Summary

Dr. Hansel introduced the specific aims of this study, which are to (1) determine whether fat mass increases susceptibility to indoor pollution in COPD, and (2) determine whether adverse diet patterns and low vitamin/nutrient levels increase susceptibility indoor air pollution. She expressed that the study goes beyond body mass index (BMI), which is a relatively crude measure that doesn't account for adiposity or dietary factors, and instead does more comprehensive analysis of diet. Researchers recruit participants in low-income communities in Baltimore with COPD, then do environmental monitoring over six months to look for changes in exposures that might link to respiratory outcomes. Researchers conduct health assessments such as lung function measurements and comprehensive clinical assessments, and make monthly telephone calls to inquire about symptom exacerbations. Researchers also administer a socioeconomic questionnaire to gain insight into financial hardship, food insecurity, stress, and social support. A co-morbidity assessment inquiry is also administered regarding depression, anxiety, cognitive impairment, alcohol intake, and sleep apnea. Researchers measure adiposity using duel-energy x-ray absorptiometry (DEXA) scans as well as more traditional measures such as BMI and skin calipers. Researchers administer a food frequency questionnaire and collect blood samples to measure vitamin and nutrient levels.

Significant Results

One-third of participants reported food insecurity. Food frequency questionnaires show that on average, participants consume low levels of anti-inflammatory omega-3 and high levels of pro-inflammatory omega-6.

Project 2: Environmental Health Disparities in Rural Appalachia: The Impact of Air Pollution, Obesity and Diet on COPD Morbidity

Presentation Summary

Dr. McCormack introduced this project as a partnership between JHU and East Tennessee State University. She pointed out that a nationally representative sample showed that residents in rural, poor regions had increased prevalence of COPD. In Tennessee, where this project is being conducted, there is an inverse relationship between income and prevalence of COPD. This project involves more exposure assessment compared to Project 1. Sources of indoor air pollution in rural Appalachia include smoking, secondhand smoke and biomass burning. There have been many opportunities for training, outreach, and education at the Tennessee study site. Researchers have assembled a community advisory board to provide guidance on recruitment strategies and concerns of the community. Dr. McCormack described the demographics of the Tennessee study population, which vary from those of the Baltimore study population.

Community Engagement Core (CEC)

Presentation Summary

Dr. Galiatsatos introduced the CEC, whose mission is to promote the science and medicine of lung health to interface with community and citizens, both locally and globally. The CEC oversees the Community Research Advisory Council (CRAC), a board of community members formed to promote public trust, understanding, and involvement in health research. The CRAC recommended partnerships with public housing units in Southwest Baltimore, where researchers were able to recruit participants for the study and communicate health information related to smoking and COPD. The CEC has also partnered with the local Islamic community to communicate health information related to smoking and COPD.

Significant Results

The CEC recently published an article on the relationship between tobacco store density in low-income neighborhoods and death from chronic lung disease.

Next Steps

The CEC will work to develop a social media presence with input from the CRAC. They will also develop additional tools to disperse research findings, such as a science tool kit for elementary and high school students.

For a copy of the CURE COPD Center meeting presentation slides, contact Dr. Nadia Hansel at nhansel1@jhmi.edu.

Working Group Discussions and Report-Back

Summary

In the afternoon, participants split up into four working groups to explore improved approaches for addressing key cross-center challenges in the following categories: Research Translation; Cross-Center Collaborative Publications; Data Harmonization; and Community Partner Feedback. The conference organizers provided previously developed questions for consideration by each group. The groups met in different areas of the conference space, then reported back to the auditorium to share their discussion results with the rest of the participants. UNM arranged for volunteers to take notes for each of the groups, except for the Community Partners group, which met in a closed session to organize their feedback for the afternoon listening session.

I. Research Translation

Questions:

1. How is research translation best optimized by the EHD Centers for the various targeted audiences (i.e., scientific community, federal/state/local governments, community leaders)?
2. What resources or skills are needed at your Center to ensure that the technical details/information content and format are appropriate for the different audiences?
3. What communication/outreach vehicles/formats should be considered when disseminating research results? How do they vary in light of the target audience?
4. What role does/should social media play? What would you consider to be best social media practices for the EHD Centers?

Discussion:

1. How is research translation best optimized by the EHD Centers for the various targeted audiences (i.e., scientific community, federal/state/local governments, community leaders)?
    - Reduce the number of acronyms; can be overwhelming, e.g., reading posters and remembering what acronyms are. It is distracting. “Make sense of the alphabet soup.”
    - Multidisciplinary nature helps with translation, must be conscious of language to describe relationships and terminology. Force people to become fluent with each other and multidisciplinary to interact with other groups, e.g., social sciences.
    - Create templates to create lay relationships, “don’t reinvent the wheel.” Streamline communications so target audience members don’t see different explanations or acronyms for the same terms.
    - In the case of documents such as a government executive summary 1-pager, though science is complex, it is required to make text short and clear. Must be scientifically accurate but clearly communicated or end person will glaze over. Be scientific without using science words.
    - Be specific about what goals need to be communicated (e.g., am I talking to representatives to address issues, or a community). Research Translation (RT) should to be specific to targets.
    - Range of different specialists are investigating and thinking about translation every day. How it impacts policies, individuals, and broader questions of public health. Force people to retrain their thinking, i.e., “*What does this research mean*?” Communicators should use lay terms for public health, public policy, cousin, neighbor, etc. People who are deep into scientific frames of mind may not be effectively making the translations. RT may not be appropriately delivered by everyone. Need to think about how messages can be translated by making the right person communicate it properly.

- Think about how to explain future value of research even though this value may not be obviously apparent with respect to applications being currently developed.
- People will often say when they don't understand and can offer valuable feedback on what to do and what not to do. This will balance the rigors and challenges of being a scientist with being engaged with community and other peoples.
- Often times the community needs to know the hard facts, e.g., need to know the major policy decisions (e.g., to irrigate or not?).
- Use a solution-oriented approach to put message in empowering light, not just what the problems are and why they are bad.
- Discussion is community based.
- Use what best practices (i.e., what is best for engaging with investigators). Understanding the audiences, template development (or communication tools), and use solution oriented messages.
- What are the positives, (e.g., the toxics and treasures tour, not just the toxics)? Talk about the good and the bad (e.g., church in community, school doing good vs. bad stuff).
- Training aspects, i.e., identifying best practices, sharing materials best developed, and common themes for working together for research translation purposes.
- Capacity building for community partners.

2. *What resources or skills are needed at your Center to ensure that the technical details/information content and format are appropriate for the different audiences?*
   (Brainstorming topics: Audiences, Barriers to Effective Science Communication, Resources, Skills)
   - Audiences
     Tribal leadership chapter and local level; Representatives (elected); Study participants; Collaborating physicians; Healthcare professionals; Environmental health organizations; Graduate student interns; Mothers; Farmers; Traditional healers; Community organizers; Property owners, Managers/staff; Employees of agencies; Media; Effected community members; Faith organizations; Charitable organizations; Teachers; School boards; Health councils; Community health workers; Unions
   - Barriers
   - Language barriers; Taboo to talk about health in some cultures (e.g., Navajo); EMAs; Fear of research; Illiteracy; Immigration status; Distrust of academic institutions, funding agencies or the government; Geography; Distrust of monitoring and sampling equipment; Religion
   - Resources
     - Editorial boards – Community people and internal review policy; derived from best practices (as discussed above)
     - Many communities discuss digital stories (with multiple languages in captions), (2 minutes/short), (what is the main message, what can I do to protect myself, what is next?)
     - Podcasts; YouTube, PSAs; Webinars; Digital Storytelling
     - Infographics – results for community, brochures, identify with problems in own community
     - "Bite, snack, meal" Progressive information supply to only provide enough material as desired by recipient "headers – summary – full text"
     - Artists
     - Radio
   - Skills
     - Engaging with media
     - Cultural sensitivity. Do not disrupt or interrupt an elder (e.g., should offer food for elders in Native communities)
     - Age dependent – engage with community in proper fashion

- How do we know when you're successful with getting info across? *Metric of success*
- Use proper evaluator (e.g., people aren't drinking unregulated water anymore after a period of 15 years.) Time scale?
- Audience and research team provide evaluations based on measure of success of each other to ensure that progress was made and goal was met

Other considerations:

- There was mention of a metrics manual from EPA. However, most people in the room were not very familiar with this manual. (This may be a reference to an EPA document entitled, "*Community Engagement Strategy: Issues to Consider When Planning and Designing Community Engagement Approaches for Tribal Integrated Waste Management Programs*," which can be accessed at https://www.epa.gov/sites/production/files/2017-03/documents/tribalswcommunityengagementstrategy508.pdf.)
- A free online resource from NIEHS identifies criteria necessary for researchers to evaluate success. No metric for success prior to this with community engagement. Created metrics to help measure success with leveraging resources, etc. This manual has five different chapters. Program analysis team can do a webinar to walk through the manual. This is not a recipe type book telling exactly what needs to be done, it is a guide for facilitators to define whether the research team has been successful. There's also a training video also that contains what the measures of success are. (This is a reference to the NIEHS Partnerships for Environmental Public Health Evaluation Metrics Manual, which can be accessed at https://www.niehs.nih.gov/research/supported/translational/peph/metrics/index.cfm.)
- Interpreters, people who are multi-fluent. Translations can be finicky otherwise. Culturally-appropriate or sensitive (e.g., resilience into google translate, several languages don't have translation.)

3. *What communication/outreach vehicles/formats should be considered when disseminating research results? How do they vary in light of the target audience?*
   - Know the audience to make sure the right vehicle is used
   - Need the right vehicles to bring knowledge and message to the community
     - Website, outreach/educational activities (verbal)
     - Social media – Twitter, YouTube, Facebook, blogs
     - Listservs
     - Newsletters
     - Point person (liaison); Community gatekeeper (making sure not to alienate anyone is hard to do). This happens especially happens when it is a controversial topic such as a spill or SUPERFUND
     - Community health representatives and workers
     - Student Interns go do outreach projects with community partners to disseminate message to community (education sessions, environmentally friendly considerations)
     - Health fairs, community forums, science cafes, science on tap (community engagement)
     - Farm board meetings, chapter meetings
     - Senior Centers
     - Billboards
     - Tabling events
     - Advertise at places of relevance (e.g., feed store for farmers)
     - Using relatable metrics to discuss important acronyms (e.g., PPB = drop in a trough, grain of rice in a sack)

- Community forum – Conferences (Institution Review Boards), sign a contract that you'll go out and disseminate projects
- Community health fair, newspaper
- Mail newsletters because not everybody has email
- Advertising in regional newspapers, radio
- *Make sure all members of community know what is happening*
- Research monographs – policy makers, the Department of Justice, EPA., etc. Activist groups, community groups who are addressing policy change
- Have copies of publications distributed
- Radio forums; traditional healers and scientists; call in shows (to record or not record?)
- Documentaries that lead to film festivals and more opportunities to spread the message
- Tribal training sessions where community members come and tell their stories (less than 5 minutes)
- Graphic novels, zines
- Multigenerational ads or messages (e.g., with a pregnant mom and grandma making blue corn mush, granddaughter translating the message, blue-corn mush has zinc -> leads to science discussion while relating to audience)
- Photovoice
- Artistic notetaking - graphing type in a culturally appropriate manner (e.g., how immune system works), translation (scientific and language translation)

4. *What role does/should social media play? What would you consider to be best social media practices for the EHD Centers?*
   - This is bled into Question 3, started to run out of time during this working group discussion. Following are topics to discuss further

   WRAP UP: Next steps: What do we want to do?
   - Hear more from other centers on template ideas. Presenting to community meetings, what are the main points needed to be addressed? – A list of questions that a PI needs to be able to address for communication.
   - Examples of how to provide results – conveying the message in an audience-specific fashion so the audience understands the message; conveying complex messages to participants without environmental literacy.
   - Evaluation: how do we know if we have a good product. Is it being used, is it helpful?
   - What do the numbers mean, should I care, and what should be done about it? This message is what needs to be communicated to audience.
   - Sight is loss of opinion and expertise, and too much importance is placed on statistical powers and p-values. Trapped by objectivity and opinion to express true opinion and advice. Should give same advice to family as to community, and make sure that expertise, years of knowledge, and opinion are combined with statistical knowledge and scientific facts.
   - Making people aware of issues. How do we help them deal with them? It doesn't stop with conveying the message, the scientists must also help to deal with the message. Should impact all equally.

II. Cross-Center Collaborative Publications

Questions:

1. What are possible topics for cross-center collaboration?
2. What are some common cross-center characteristics that could be explored for collaborative reporting/publication?
3. A cross-center joint effort has been proposed for development/management of community advisory boards. What other technical or community-based best practices could be explored for the EHD Centers?
4. Which, if any, cross-center social/economic/scientific methodologies or approaches can be highlighted in a joint publication effort?

Discussion:

1. *What are possible topics for cross-center collaboration?*
    - Topics such as resilience/thought piece
        - Resiliency of communities – be protective of health – what can we learn from these communities?
        - Context specific mediator
    - Community engagement core activities
        - Methods for engagement
        - How the community likes to engage with the research
    - Conceptual model of environmental health disparities/thought piece
        - Dimensions of environmental health
    - Collaborative methods/methodologies
    - Epidemiological analysis
        - Psychological stress and outcomes
    - Nutrition
        - Zinc supplementation, supporting nutrition
    - Chronic disease
    - Toxic metals exposure
        - Different communities: high rates of exposure – compare and contrast
    - Population comparison
    - Context specifics of health disparities populations
        - How to approach communities
    - Commonalities in exposure and outcomes across communities
    - Gold King Mine Spill (disaster) disparate impacts
    - Economics/cost benefits
    - Rural vs. urban
        - Try to understand the heterogeneity
    - Evaluation
    - Positive adaption
    - Historical research mistrust
    - Informing policies
        - Where research can inform policy
    - Source and composition of PM indoors and outdoors
    - Stress
    - Factors outweighing environmental health

  - Example: kids playing outside on the playground
  - Collaboration Gold King Mine Spill – Navajo Nation – between UNM and Arizona
  - To include a community member in a paper, use a quote from him/her to preserve thought
  - Many don't do a thought piece – what are the challenges?
  - Solution-focused interventions

Other: How to facilitate a collaborative publication?

- Set up a writing team with representation from participating centers
- Determine if there is a clear journal, clear analysis
- Identify lead author early
- Start with an outline and timeline
- Meet monthly initially
- Can pursue with or without NIH/EPA assistance
- Conceptual can start soon – data driven may need to wait
- Who drives the whip? Can be NIH/EPA – will push through to make deadlines. Can be PI – especially conceptual
- Whip needs to have momentum, needs to be driven and engaged
- NIH/EPA can arrange for an in-person meeting space. Bring selected writing teams together (infrastructure)

Conclusions

- How the process would be managed – infrastructure
- Two centers or perhaps more on a collaborative piece
- Conceptual paper (see below)
- Paper on community engagement
- Metal exposure is a major commonality between the centers
- How to counteract research distrust
- Perception versus actual risk

III. Data Harmonization

Questions:

1. What does data harmonization mean for EHD centers?
2. What is needed related to EHD centers generated data (e.g., long-term storage)? Are there additional needs for resources for data analysis and data sharing?
3. What opportunities and challenges for data sharing currently exist among the centers?
4. What recommendations do you have for improving data collection, storage, analysis, or sharing across the centers or with other investigators?

Discussion:

1. What does data harmonization mean for EHD centers?

- The centers are, and have been, collecting data, instrumentation, etc., so one of the main aims of this session is to identify the overlaps of these projects and data
- Look for similar types of data across projects
- Collection of data by each center, and then how to generalize/make compatible/share it
- Data harmonization of already-existing data

2. What is needed related to EHD centers generated data (e.g., long-term storage)? Are there additional needs for resources for data analysis and data sharing?

- Funding
- Employee hours
- Long-term storage
- Data normalization

3. What opportunities and challenges for data sharing currently exist among the centers?

- Challenges
  - Must avoid "lumping together" different AI/NA populations in order to provide "aggregate" data
  - Data sharing restrictions/agreements, especially in tribal populations
    - Approval of uses of data would be required through appropriate tribal approvals
  - Resources (time/effort/energy and funding for data harmonization)
  - Note: Data harmonization was not an included aim for P50 funding, but P50 provides the opportunity to do so. For data harmonization to occur across projects, additional support would need to be provided. Data harmonization takes a large amount of time and effort, and current funding/plans would not be sufficient to accomplish the task.
- Opportunities
  - Knowledge sharing – How to share "lessons learned" to add incremental value, efficiency to other projects
  - Comparative projects of summary data
  - Review paper cross-center collaboration (e.g., psychosocial exposure modifies environmental exposure)

4. *What recommendations do you have for improving data collection, storage, analysis or sharing across the Centers or with other investigators?*

- Variation in data collected and data types, doesn't necessarily make sense to have centralized storage

- Figure out what "gold standard" methods are for collection (for future)
- Method expertise sharing
- Recommendations for harmonizing data in general
- Clearer protocols for using cloud storage

IDEAS

- Figure 2 (developed by Dr. Joseph Hoover, UNM) depicts a conceptual model of cross-center collaboration among the EHD centers
- Website or forum to propose questions
- Cross-collaborative funding, especially for trainee fellowships (post-docs)
- Incorporate citizen science, since it seems like a natural thing to do with centers that involve environmental modeling and community engagement

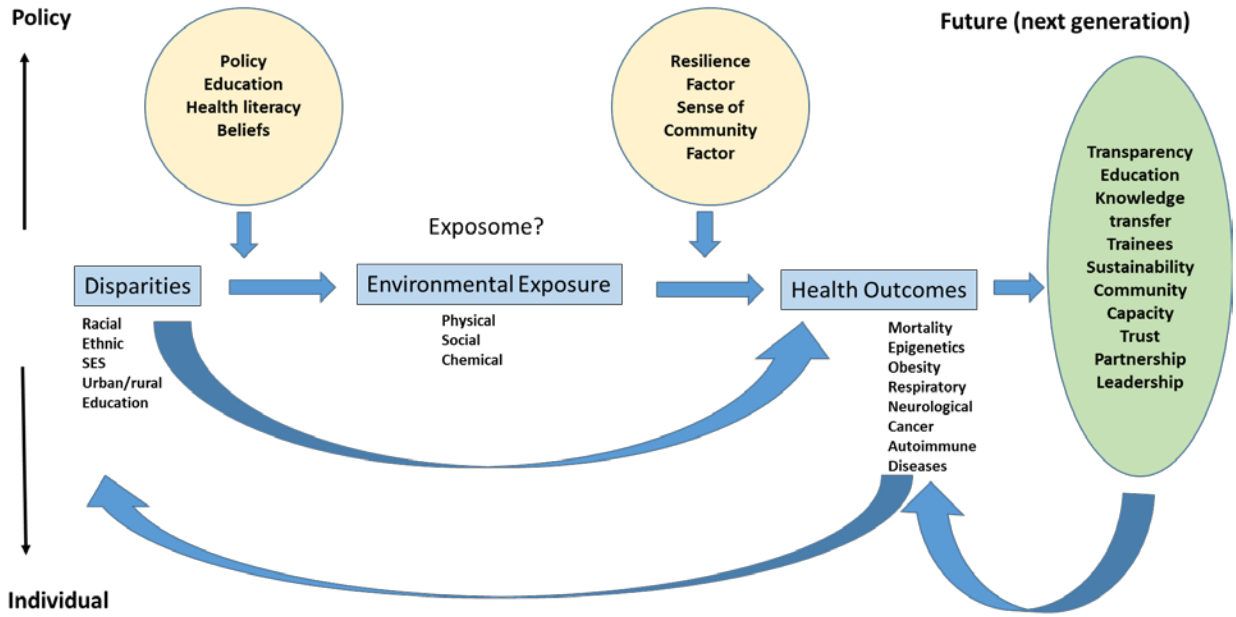

Figure 2: Conceptual Model - Cross-Center Collaboration by the EHD centers (developed by Dr. Joseph Hoover, UNM)

GOALS BEFORE THE NEXT MEETING

- Find collaboration opportunities (how?) of the science, or new products, then figure out how to harmonize the data appropriately
- Monthly calls
- Establish topical working groups and/or contact lists (e.g., metals, airway/breathing, outreach, etc.)
- Use total database, give to trainees, researchers to identify projects
- Identification of simple, no- or low-cost measures that can be added to a project to create data harmonization in the future

Appendix A: Speaker Biographies

EHD Center Program Managers

Maggie Breville, M.S.

Research Program Manager, Water, Health, and Innovation Division, NCER, ORD, EPA

Maggie Breville is an Environmental Scientist with over 30 years of experience in the field. She joined the Environmental Protection Agency's National Center for Environmental Research (NCER) in 1995, where she currently serves as a Research Program Manager under the Science To Achieve Results (STAR) grants program, and oversees the NIH/EPA Centers of Excellence on Environmental Health Research program, as well as the STAR Environmental Public Health Indicators and Cumulative Risk Assessment research portfolios. She also serves as Deputy Project Lead for the Environmental Health Disparities and Vulnerable Groups Project of EPA's Sustainable and Healthy Communities (SHC) research program. Previously, Ms. Breville was Acting Director of NCER's Peer Review Division, where she led scientific and technical reviews for the student fellowships and extramural research programs. She has also worked as a Remedial Program Manager in EPA's Region II (NY) office on Superfund hazardous site remediation activities. Prior to joining EPA, Ms. Breville was a Biology Consultant with the NUS Corporation and an Analytical Chemist with the NYC Department of Environmental Protection's Drinking Water Bureau. Ms. Breville holds a Master's degree in Environmental Science and Management from Tufts University and a Bachelor's of Science degree in Biology from Wagner College.

Gwen Collman, Ph.D.

Director, Division of Extramural Research and Training, NIEHS, NIH

Dr. Collman is director of the National Institute of Environmental Health Sciences, Division of Extramural Research and Training, where she leads approximately 80 professional staff in areas of scientific program administration, peer review, and the management and administration of about 1,000 active grants each year. She directs scientific activities across the field of environmental health sciences including basic sciences, organ-specific toxicology, public health-related programs, and training and career development. She also oversees the implementation of the Superfund Research Program and the Worker Education and Training Program.

Symma Finn, Ph.D.

Health Science Administrator, Population Health Branch, Division of Extramural Research and Training, NIEHS, NIH

Dr. Finn is a Health Scientist Administrator with the Population Health Branch of the Extramural and Training Division (DERT) at the National Institute of Environmental Health Sciences. She received her Ph.D. in medical anthropology from the University of Florida in 2008 for her work on quantifying empowerment in a rare genetic disease community. She has a M.A. from the University of Miami in environmental anthropology for her work on the anthropological aspects of ecosystem management, and an undergraduate degree in communications from Adelphi University. Dr. Finn has conducted research on physician-nurse-patient communication and shared decision making as a postdoctoral fellow at Florida. She has served as director of research and grants for the Alpha-1 Foundation, a rare genetic disease organization, and as administrative assistant to

the dean of the Rosenstiel School of Marine and Atmospheric Science. Dr. Finn joined DERT in December 2011 after concluding an American Association for the Advancement of Science (AAAS) Policy Fellowship in the NIH Office of Science Policy/Office of Biotechnology Activities. She administers social and behavioral research and develops new areas of interest in communications and environmental health literacy. She is overseeing communication and outreach and community resilience activities for the Deepwater Horizon Research Consortium, and is involved in the Breast Cancer and the Environment Research Program, Partnerships for Environmental Public Health, and in other programs that deal with health disparities, environmental justice, and communications.

Sylvana Li, Ph.D.

Director, Water, Health, and Innovation Division, NCER, ORD, EPA

Dr. Li serves as Director of the Water, Health and Innovation Division at the National Center for Environmental Research of the Environmental Protection Agency and provides leadership and direction for external research programs on sustainable water resources, human health, Small Business Innovation Research, and People, Prosperity, and the Planet. From 2007 to 2010, Dr. Li was Branch Chief of Rural Development and Natural Resources at the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture (USDA), and oversaw operations of worldwide capacity building development programs on water resources, environment, and sustainable agriculture. Previously, Dr. Li served as an Agricultural Research Advisor at FAS, USDA, and was responsible for a large portfolio of water and environment bilateral and multilateral collaborations in countries and regions including China, India, the Middle East, and North Africa. She also served as Principle Investigator at The Shaw Environmental and Infrastructure, Inc., and managed projects on drinking water treatment, water distribution system monitoring and modeling, wastewater reuse, and watershed management in U.S. and China. She also served as a Mechanical Engineer at the National Risk Management Research Laboratory of EPA. Dr. Li received her Ph.D. in Environmental Engineering from University of Cincinnati, Master of Environmental Science from Miami University, and B.E. in Mechanical Engineering from Beijing Union University in China.

Liam O'Fallon, M.A.

Health Specialist, Population Health Branch, Division of Extramural Research and Training, NIEHS, NIH

Liam O'Fallon joined the Division of Extramural Research and Training in 1999, he has been actively involved in research programs at the National Institute of Environmental Health Sciences that support community participation in research. Mr. O'Fallon leads the Partnerships for Environmental Public Health program at the NIEHS, which fosters interactions among projects from different NIEHS-funded programs with a focus on community engagement and a commitment to public health action. He directs the Community Engagement Cores that are a part of the network of Environmental Health Science Core Centers, the Centers for Children's Environmental Health Program, and the Centers of Excellence on Environmental Health Disparities Research across the country. Mr. O'Fallon is particularly interested in communication research in the context of environmental public health and health disparities. He is also a member of the HHS Environmental Justice working group. Before coming to NIEHS, Mr. O'Fallon worked at the U.S. Department of Health and Human Services, in the Office of International and Refugee Health where he coordinated an interagency, binational working group addressing environmental health issues along the

U.S.-Mexico Border. Mr. O'Fallon received his Master's degree in Latin American Studies, specializing in medical anthropology and international health, from Tulane University in 1997.

Nishadi Rajapakse, Ph.D.

Program Director, Division of Scientific Programs, NIMHD, NIH

Dr. Rajapakse, is a program director in the Division of Scientific Programs at the National Institute on Minority Health and Health Disparities, where she directs the Transdisciplinary Collaborative Centers for Health Disparities Research Focused on Precision Medicine (U54) initiative, NIMHD's first venture into the field of precision medicine. This is a unique focus on understanding the complex interplay between biological, behavioral, social and environmental factors in developing new diagnostic or therapeutic approaches. In 2011, she led a new collaboration with the EPA on a novel pilot initiative to establish environmental health disparities cores within existing NIMHD Centers of Excellence. Currently, Dr. Rajapakse leads the Centers of Excellence on Environmental Health Disparities Research Program at NIMHD. In addition, she serves as a Program Official for the NIMHD RO1 program, and the Research Centers in Minority Institutions program. Dr. Rajapakse received her Ph.D. in Molecular Medicine and Translational Sciences from Wake Forest University where her research focused on traumatic brain injury in adults and newborns and targeting mitochondria in developing therapies to hypoxia-ischemia induced sequelae. She completed her postdoctoral fellowship in genetic epidemiology at the NIEHS where she examined genetic and environmental risk factors in the development of cardiovascular disease, sepsis and rheumatoid arthritis. Dr. Rajapakse also holds a Master's degree in Clinical Research from Duke University. She has published more than 25 peer-reviewed articles in biomedical journals and served as a guest editor for The Journal of Health Care for the Poor and Underserved.

Michael Sayre, Ph.D.

Branch Chief, Integrative Biological and Behavioral Sciences, Division of Scientific Programs, NIMHD, NIH

Dr. Sayre oversees a broad research portfolio focused on minority health and health disparities, including research on the potential of precision medicine to address care gaps for underserved populations. He also serves on advisory and leadership committees in partnership with NIH. Prior to joining NIMHD, Dr. Sayre was the deputy director of the Division of Research Infrastructure in NIH's National Center for Research Resources, which later became the National Center for Advancing Translational Sciences. Earlier in his career, he conducted independent research on fundamental mechanisms of gene regulation as a faculty member at JHU. Dr. Sayre earned his B.S. in botany and plant pathology from Oregon State University in 1983 and a Ph.D. in molecular genetics from the University of California, San Diego, in 1989. He completed postdoctoral training at Stanford University School of Medicine, studying molecular mechanisms of gene regulation in the yeast Saccharomyces cerevisiae. Dr. Sayre has published 30 peer-reviewed journal articles.

NIH-EPA EHD Center Directors

Carrie Breton, Sc.D.

Co-Director, MADRES Center, University of Southern California

Dr. Breton is Associate Professor of Preventive Medicine at the Keck School of Medicine of USC and is Co-Director of the MADRES Center. She also co-directs the USC program site for the Environmental Influences on Child Health Outcomes (ECHO) program. Dr. Breton's work addresses the interplay between genetics, epigenetics and susceptibility to environmental exposures such as air pollution and tobacco smoke on health outcomes in children. Her work in the MADRES Center examines whether pre- and postpartum environmental exposures, coupled with exposures to psychosocial and built environment stressors, lead to excessive gestational weight gain and postpartum weight retention in women and to perturbed infant growth trajectories and increased childhood obesity risk. Her work in ECHO takes a multigenerational life course approach to studying the contribution of the environment to the developmental origins of childhood and emerging adult respiratory and metabolic health. She has conducted several other studies investigating how environmental exposures alter epigenetic profiles in newborns and young children, and what roles those changes play in underlying disease risk. Dr. Breton holds an Sc.D. in Epidemiology from Harvard, an M.P.H. from UCLA, and a B.A. from Amherst College.

Jeff Burgess, M.D., M.S., M.P.H.

Co-Director, CIEHR, University of Arizona

Dr. Burgess is the Associate Dean for Research and a Professor at the UA Mel and Enid Zuckerman College of Public Health. He completed medical school at the University of Washington, followed by an Emergency Medicine residency, a Medical Toxicology Fellowship, a Master's of Science in Toxicology/Industrial Hygiene at UA. It was also there that he completed an Occupational and Environmental Medicine Fellowship, as well as a Master's of Public Health in Environmental Health. His research focuses on improving environmental and occupational health and safety, public health preparedness, as well as working in partnership with indigenous communities, firefighters, and other groups.

Frank Gilliland, M.D., Ph.D., M.P.H.

Co-Director, MADRES Center, University of Southern California

Dr. Gilliland is an established leading investigator in air pollution research, respiratory health and cancer epidemiology, and gene-environment interactions, and he has been the principal investigator for many epidemiological investigations. Since arriving at USC in 1997, he has published more than 190 scientific papers. Dr. Gilliland is Hastings Professor of Preventive Medicine at the Keck School of Medicine of USC. After obtaining a master's degree in physics, he received his medical degree from the University of Virginia, followed by a residency and fellowship in occupational and environmental medicine at the University of Minnesota, where he received his M.P.H. and Ph.D. in environmental epidemiology. He also obtained board certification in emergency medicine and in environmental and occupational medicine. Prior to his appointment at USC, Dr. Gilliland was a faculty member at the University of New Mexico, focusing on occupational and environmental determinants of malignant and non-malignant respiratory disease as well as prostate and breast cancer.

Melissa Gonzales, Ph.D.

Co-Director, CNAEHER, University of New Mexico

Dr. Gonzales is an Associate Professor in the Division of Epidemiology, Biostatistics and Preventive Medicine at the University School of Medicine. She holds a doctoral degree from the University of California Berkeley, School of Public Health, and master and bachelor degrees from UA. She co-directs the UNM Native Environmental Health Equity Research Center, and is a researcher in the UNM METALS Superfund Training and Research Center. She is the Director of Evaluation and Research at the UNM Health Sciences Center Vice Chancellor's Office for Diversity. Dr. Gonzales has been a member of several National Academies of Sciences committees and ad-hoc NIEHS and NCI study sections providing expertise in environmental exposure assessment, epidemiology, and health disparities.

Nadia Hansel, M.D., M.P.H.

Director, CURE COPD Center, The Johns Hopkins University

Dr. Nadia Hansel is an Associate Professor of Medicine at JHU with joint appointments in the Division of Allergy and Clinical Immunology at the JHU School of Medicine and the Department of Environmental Health Sciences at the JHU Bloomberg School of Public Health. She assumed the position of the Associate Dean of Research for the Bayview Campus, JHU School of Medicine in July 2014 and is Assistant Director to Clinical Research in the Division of Pulmonary and Critical Care Medicine. Dr. Hansel received her undergraduate degree magna cum laude in biology from Harvard College and her medical degree from Harvard Medical School. She completed her internal medicine residency at the University of Pennsylvania and came to JHU to complete her Pulmonary and Critical Care fellowship. She subsequently completed her Masters of Public Health Degree from the JHU Bloomberg School of Public Health. Dr. Hansel's research is focused on the environmental and genetic determinants of obstructive lung diseases. She is widely recognized as an international expert in defining the indoor air quality on asthma and COPD. Her work has been instrumental in showing that indoor pollutants contribute to respiratory morbidity in patients with COPD and children with asthma.

Francine Laden, Sc.D., M.S.

Co-Director, CRESSH, Harvard University

Dr. Laden is Professor of Environmental Epidemiology at the Harvard T.H. Chan School of Public Health, and an Associate Professor of Medicine at the Harvard Medical School and the Brigham and Women's Hospital. Dr. Laden received her Sc.D. in Epidemiology and M.S. in Environmental Health from the Harvard School of Public Health. Her research interests focus on the environmental epidemiology of chronic diseases, including cancer, respiratory and cardiovascular disease. Her research has or is concentrated on the following categories of exposures: air pollution, persistent organic pollutants, secondhand smoke, and the contextual environment. Dr. Laden is specifically interested in the geographic distribution of disease risk, incorporating geographic information system technology into large cohort studies to explore risk factors such as the built environment and indicators of socioeconomic status, as well as air pollution. She has published key papers on the association of ambient particulate matter and all cause and cardiovascular mortality in the Harvard Six Cities Study and the Nurses' Health Study and on

the association of diesel exhaust exposures in the trucking industry and lung cancer mortality. She is currently Co-Director of CRESSH, which studies environmental health disparities in low-income communities and throughout Massachusetts. Dr. Laden is Past President of the International Society of Environmental Epidemiology and the Associate Chair of the Department of Environmental Health.

Jonathan Levy, Sc.D.

Co-Director, CRESSH, Boston University

Dr. Levy is Professor and Interim Chair in the Department of Environmental Health at Boston University School of Public Health. His research centers on urban environmental exposure and health risk modeling, with an emphasis on spatiotemporal exposure patterns and related environmental justice issues. Recent and ongoing research topics include evaluating spatial patterns of air pollution in complex urban terrain, developing methods to quantify the magnitude and distribution of health benefits associated with energy efficiency and renewable energy measures, using systems science approaches to evaluate the benefits of housing interventions on pediatric asthma, and developing methods for community-based cumulative risk assessment that includes chemical and non-chemical stressors. He co-directs CRESSH, which involves interdisciplinary research activities connecting environmental epidemiology, exposure science, and health disparities modeling, with a focus on the indoor environment and community-engaged research. He has been a member of several National Research Council committees, including the Committee on Science for EPA's Future, the Committee on Health Impact Assessment, and the Committee on Improving Risk Analysis Approaches. He also served on the Advisory Council on Clean Air Compliance Analysis, which provided guidance on the impact of the Clean Air Act on health, the economy, and the environment.

Johnnye Lewis, Ph.D.

Co-Director, CNAEHER, University of New Mexico

Dr. Lewis is a toxicologist and the developer and director of the Community Environmental Health Program at the University of New Mexico Health Sciences Center College of Pharmacy. She co-directs the Center for Native Environmental Health Equity Research, and over the years has built a strong multi-disciplinary team investigating multiple aspects of environmental influences on health outcomes in Native communities as a result of exposures to metal mixtures from abandoned mine waste. She currently directs the Navajo Birth Cohort Study and the follow-on Navajo Birth Cohort Study/Environmental influences on Child Health Outcomes (NBCS/ECHO) program studying the effects of waste on developmental outcomes through five years of age, and the UNM METALS Superfund Research and Training Center. These and related projects are providing a picture of the effects of exposures to metal mixtures across tribal communities and over three generations, and conducting mechanistic studies to inform intervention. Her work has focused on building partnerships among researchers, communities, health care providers, and policy-makers/regulators locally, nationally, and internationally to ensure that research is driven by community needs and ultimately improves both health care and the development of policies to reduce exposure.

Stephanie Carroll Rainie, Dr.P.H., M.P.H.

Co-Director, CIEHR, University of Arizona

Dr. Rainie (Ahtna Athabascan) is Assistant Professor, Public Health Policy and Management at the Community, Environment and Policy Department, Mel and Enid Zuckerman College of Public Health; Assistant Research Professor, Udall Center for Studies in Public Policy; Associate Director and Manager – Tribal Health Program for the Native Nations Institute in the UC; and Co-Director for the CIEHR. Her research explores the links between governance, health care, the environment, and community wellness.

Other Center Speakers and Presenters

Gary Adamkiewicz, Ph.D., M.P.H.

Project Lead, CRESSH, Harvard University

Dr. Adamkiewicz is Assistant Professor of Environmental Health and Exposure Disparities at the Harvard School of Public Health, where much of his work focuses on the connections between housing and health, especially within low-income communities. His research has included studies of indoor environmental conditions within the homes of children with asthma, and studies that aim to understand the factors that contribute to specific exposures such as: pesticides and other chemicals, allergens, secondhand smoke and combustion by-products. He has worked with national, state and local agencies the on projects that aim to reduce the burden of disease from indoor environmental issues. Dr. Adamkiewicz is a member of the Science Advisory Committee for the National Center for Healthy Housing, and has served on EPA's Environmental Justice Technical Guidance Review Panel. He has also served as an advisor to the World Health Organization's effort to establish indoor air quality guidelines. In 2012, The American Journal of Public Health awarded Dr. Adamkiewicz a 'Paper of the Year' honor for his work on housing as an environmental justice issue. Dr. Adamkiewicz holds a Ph.D. in chemical engineering from the Massachusetts Institute of Technology and a Master of Public Health from the Harvard School of Public Health.

Tracey Bastain, Ph.D., M.P.H.

Assistant Professor, MADRES Center, University of Southern California

Dr. Bastain attended Princeton University for her undergraduate studies and the JHU Bloomberg School of Public Health for her MPH. She completed her doctoral and postdoctoral studies in Epidemiology at USC and is an Assistant Professor of Clinical Preventive Medicine at USC. Dr. Bastian's research interests include understanding the role of environmental exposures in early life and during critical periods of development on lung growth, neurological development, asthma, obesity and metabolic outcomes and childhood growth trajectories in long-term studies of children. She directs the Population Core in the MADRES Center for Environmental Health Disparities.

Paloma Beamer, Ph.D.

Associate Professor, CIEHR, University of Arizona

Dr. Beamer is an associate professor in the College of Public Health at UA. She holds joint appointments as an associate professor of Chemical and Environmental Engineering and as a research scientist in the Asthma and Airway Disease Research Center. She is an environmental engineer by training and earned

her B.S. from the University of California Berkeley and her M.S. and Ph.D. from Stanford University. Her research focuses on understanding how individuals are exposed to environmental contaminants and the health risks of these exposures with a special focus on vulnerable populations, including children, low-wage immigrant workers, Native Americans and those in the U.S.-Mexico Border Region. The ultimate goal of her work is to develop more effective interventions and policies for prevention of avoidable cases of certain diseases such as asthma. Dr. Beamer has received a Mentored Quantitative Research Award from NIH, a Scientific Technological Achievement Award (Level I) from the EPA, and Young Investigator Award from Yuma Friends of Arizona Health Sciences. She was selected as one of Tucson's "40 under 40" and as an Emerging Investigator for an international journal, Environmental Science: Processes and Impact. She currently serves as an Associate Editor for the Journal of Exposure Science and Environmental Epidemiology. Dr. Beamer is currently the President-Elect for the International Society of Exposure Science and will begin her term as President in 2019. She is a lifetime member of the Society for Hispanic Professional Engineers and the Society for the Advancement of Chicanos and Native Americans in Science.

David Begay, Ph.D.

Research Associate Professor, CNAEHER, University of New Mexico

Dr. Begay is currently Research Associate Professor with the University of New Mexico, Albuquerque, in the College of Pharmacy, Community Environmental Health Program working with several research projects, including Environmental Health Disparities Research. Dr. Begay is also adjunct faculty at NAU, in the Department of Physics and Astronomy. He is VP for the Indigenous Education Institute, Friday Harbor, WA. He also works with NASA, JPL, and Goddard Space Flight Center on Heliophysics education. Dr. Begay is a cultural consultant to many organizations and corporations both in the U.S. and internationally. He is raised with the deep cultural knowledge, tradition, and language of the Diné (Navajo) people.

José M. Cerrato, Ph.D., M.S.

Assistant Professor, CNAEHER, University of New Mexico

Dr. Cerrato is Assistant Professor of Environmental Engineering in the Department of Civil Engineering at the University of New Mexico. He is co-leader of the Environmental Monitoring and Interpretation Core of the Native Environmental Health Equity Center, and co-investigator of the UNM METALS Superfund Research Program. Dr. Cerrato obtained a B.S. in Civil Engineering from the National Autonomous University of Honduras, and M.S. and Ph.D. in Environmental Engineering from Virginia Tech. He was also a Postdoctoral Researcher in Washington University in St Louis. His research interest is related to biogeochemical processes occurring at molecular and macro scales that affect metal cycling in the environment. He leads the E-H2O Research Group which applies spectroscopy, microscopy, aqueous chemistry, and molecular biology tools for the study of complex environmental interactions. Dr. Cerrato was a Postdoctoral Research Associate at Washington University in St. Louis. He has been a recipient of Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award, the University of New Mexico Faculty of Color Research Award, and the NSF CAREER Award.

Karletta Chief, Ph.D.

Assistant Professor, CIEHR, University of Arizona

Dr. Chief is an Assistant Professor and Assistant Specialist in the UA Department of Soil, Water and Environmental Sciences. As an assistant professor, the goal of her research is to improve our

understanding, tools, and predictions of watershed hydrology, unsaturated flow in arid environments, and how natural and human disturbances affect soil hydrology through the use of physically based methods. As an extension specialist, she works to bring relevant science to Native American communities in a culturally sensitive manner by providing hydrology expertise, transferring knowledge, assessing information needs, and developing applied science projects. As a National Science Foundation Doctoral Fellow, Dr. Chief received her Ph.D. in Hydrology and Water Resources in the School of Engineering at UA in 2007. She completed her post-doctorate at Desert Research Institute in the Division of Hydrologic Sciences in Las Vegas, NV where she worked on large weighing lysimeters at the Scaling Environmental Processes in Heterogeneous Arid Soils Project in Boulder City. Dr. Chief was named 2011 American Indian Science and Engineering Society (AISES) Most Promising Scientist or Scholar. She has received awards for the 2013 Stanford University Distinguished Alumni Scholar, the 2015 Native American 40 under 40, the 2016 AISES Professional of the Year, the 2016 Phoenix Indian Center Woman of the Year, and is a 2017 Stanford University Multi-Cultural Hall of Fame Inductee. In December 2017, Dr. Chief was featured in Science Friday's "Breakthrough: Portraits Of Women in Science" in a short film entitled, "I am Bitter Water: Protecting the Waterways of the Navajo Nation."

Esther Erdei, Ph.D.

Research Assistant Professor, CNAEHER, University of New Mexico

Dr. Erdei's overarching interest is to integrate her laboratory expertise in immunology and genetics, classical epidemiology and molecular epidemiology with environmental health problems in various communities affected by environmental toxicities and health disparities. Besides developing various early immune biomarkers to better understand pre-clinical immune system alterations as of effects of toxic metals, she has a mission to find protective factors in the disproportionally exposed that would guide public health preventive measures for Tribal communities. Dr. Erdei is the UNM HSC PI of the ongoing NIAID/NIH/Indian Health Service grant in which she carries out laboratory immune system analyses, collects epidemiological survey information and promotes exposure assessment to mercury, arsenic and pesticide contamination problem that affect the Cheyenne River Sioux, SD communities for decades. Dr. Erdei is Co-Lead with Dr. MacKenzie of the RP2 of the UNM HSC P50 Native American Environmental Health Equity Center grant. She is also a co-investigator of the federally funded Navajo Birth Cohort Study, the NBCS/ECHO study and is co-PI on the UNM METALS Superfund Research Program's BP2 project.

Patricia Fabian, Sc.D.

Project Lead, CRESSH, Boston University

Dr. Fabian is a Research Assistant Professor in the Department of Environmental Health at Boston University School of Public Health. Her research focuses on multi-stressor environmental health problems, combining expertise in systems science, environmental engineering, environmental health, respiratory infectious diseases, and GIS. She is currently the PI of an NIEHS grant building the first systems science model linking housing, indoor air quality, individual and neighborhood stressors with lung function and pediatric asthma outcomes. She is a project lead in the Center for Research on Environmental and Social Stressors in Housing Across the Life Course (CRESSH), applying GIS and spatial analytical methods to quantify and describe environmental health disparities across Massachusetts communities, and building cumulative risk models across the life course. Other research interests include developing cumulative exposure models at a Superfund site; understanding infectious disease

transmission using systems science models; and applying spatial statistical methods to study the combined effect of chemical and non-chemical exposures on pediatric neurodevelopmental outcomes.

Genevieve Fridlund Dunton, Ph.D., M.P.H.

Associate Professor, MADRES Center, University of Southern California

Dr. Dunton is an Associate Professor of Preventive Medicine and Psychology at USC. Dr. Dunton´s research examines the etiology of health behaviors related to chronic disease risk in children and adults, with a focus on physical activity and nutrition. Dr. Dunton is the Director of the USC REACH (Real-Time Eating Activity and Children's Health) lab, whose goals are to develop, test, and apply real-time data capture methodologies, including EMA and wearable sensors, to better understand the effects of time-varying psychological, social, and environmental factors on eating and physical activity episodes. She is the PI on six large studies funded by the National Institutes of Health and the American Cancer Society, author of over 100 peer-reviewed publications, and past Chair of the American Public Health Association Physical Activity Section. She is also a member of the National Academy of Sciences Panel on Physical Activity Surveillance.

Panagis Galiatsatos, M.D.

Educational Coordinator, CURE COPD Center, The Johns Hopkins University

Dr. Galiatsatos or "Dr. G" is committed to health equity and he co-founded Medicine for the Greater Good (MGG), a program at Johns Hopkins Bayview Medical Center. Since 2011, MGG has inspired hundreds of undergraduate and graduate student volunteers across JHU to help underserved city residents become advocates for their own health. On his own time, Dr. Galiatsatos speaks about chronic health conditions and takes part in screenings, health fairs and other events in schools, churches and libraries in East Baltimore. A pulmonary and critical care fellow in the JHU School of Medicine, Dr. Galiatsatos regards health disparities as "primary health issues, not just primary care issues" that transcend medical specialties.

Rima Habre, Sc.D., M.Sc.

Assistant Professor, MADRES Center, University of Southern California

Dr. Habre received her doctorate in environmental health from Harvard University in 2012 and is currently an Assistant Professor of Clinical Preventive Medicine at USC. She assesses environmental health exposures, specifically air pollution, and investigates their health effects on vulnerable populations. Her research interests revolve around methods for improving human exposure assessment to complex air pollution mixtures, including the use of cutting-edge, real-time environmental and geo-location sensors and contextual data integration methods to investigate environmental links to disease. Dr. Habre is the Director of Exposure Assessment in the MADRES Center and the LA DREAMERs ECHO Center.

Robin Harris, Ph.D., M.P.H.

Professor, CIEHR, University of Arizona

Dr. Harris is a Professor in the Epidemiology and Biostatistics Department at the UA Mel and Enid Zuckerman College of Public Health. She is also a member of the Arizona Cancer Center where she is Director of the Skin Cancer Institute and co-PI of T32 training of postdoctoral fellows in Cancer Health Disparities.

Joseph Hoover, Ph.D.

Post-Doctoral Fellow, CNAEHER, University of New Mexico

Dr. Hoover is a postdoctoral fellow in the UNM Health Sciences Center Community Environmental Health Program under the supervision of Dr. Johnnye Lewis. His postdoctoral research emphasizes the visualization and spatial analysis of heavy metal exposure throughout the Navajo Nation. Dr. Hoover is working to understand spatial patterns of exposure and links to environmental pollution. He earned a Ph.D. in Geography from the University of Denver and was awarded an EPA STAR fellowship in support of his research. Dr. Hoover's dissertation investigated the role of GIS for visualizing and conveying the water quality of unregulated drinking water wells on the Navajo Nation. He also evaluated perceptions towards using Internet GIS for conveying drinking water quality information to the general public.

Laurie Hudson, Ph.D.

Regent Professor, CNAEHER, University of New Mexico

Dr. Hudson is a Regents Professor at the UNM College of Pharmacy. Her research focuses on different aspects of cancer biology, including the contributions of environmental metals to cancer and novel therapeutics for ovarian cancer. Her environmental metals studies investigate metal disruption of zinc finger DNA repair proteins. The research specifically focuses on metal-protein interactions, cell and animal models of DNA damage and carcinogenesis, and the impact of metal exposure in human populations. Dr. Hudson's ovarian cancer research concerns the mechanisms of metastatic disease and the potential for repurposed drugs to offer novel treatment options, and spans understanding the basic molecular mechanisms to conducting preliminary human clinical trials. Dr. Hudson received a B.S. in zoology and a B.S. in biology from the University of Washington in 1980 and her Ph.D. in pharmacology and toxicology from Harvard University in 1985. She completed post-doctoral training in molecular endocrinology at the University of California, San Diego, and joined the UNM faculty in 1997.

Jani C. Ingram, Ph.D.

Professor, CIEHR, Northern Arizona University

Dr. Ingram, Professor of Chemistry and Biochemistry, investigates environmental contaminants with respect to their impact on health. A major part of her research is focused on characterizing uranium and arsenic contamination in water, soil, plants and livestock. A critical aspect of her research is to foster collaborations with the Native American community and leaders to build trust, obtain access to field samples and gain insights into their health concerns. Recruiting Native American students to work with her as a Navajo principal investigator on the project and building an interdisciplinary, collaborative team of scientists with expertise in analytical chemistry, geoscience, cancer biology, and social sciences are also important to her research. She is a member of the Navajo Nation (born to the Náneesht' ézhi clan) and is involved in outreach activities for Native American students in undergraduate and graduate research.

Jill Johnston, Ph.D.

Assistant Professor, MADRES Center, University of Southern California

Dr. Johnston is an Assistant Professor and Director of Community Engagement in the Division of Environmental Health at USC. Broadly, her research focuses on addressing unequal exposures to harmful contaminants that affect the health of working poor and communities of color. She engages in collaborations with grassroots organizations to conduct community-engaged action-oriented research at USC to support environmental justice.

Michael Lerma (P'urhépecha), Ph.D., M.A.

Associate Professor, CIEHR, Northern Arizona University

Dr. Lerma is Associate Professor of Politics and International Affairs and Applied Indigenous Studies at NAU. His recent research has explored the efficacy of traditional Diné (Navajo) institutions of governance. Michael also contributes to research conducted by Diné Policy Institute (DPI). He teaches courses on International Relations, Tribal Government, Native American Politics, and Research Methods. Dr. Lermer's research generally advocates for future Native Nation building via consolidation of Indigenous interests and expansion of Native Nation control of norms within the international political economy.

Brian Mayer, Ph.D.

Associate Professor, CIEHR, University of Arizona

Dr. Mayer is an associate professor in the UA School of Sociology. His research interests focus on the social production of environmental health risks and the contestations that emerge around environmental problems in the areas of science, policy, and medicine. His work in environmental sociology has examined the role of community activism and participation in the identification and management of potential environmental health risks. Through his qualitative research methodology, Dr. Mayer often makes use of community-based participatory research to engage local stakeholders in the research process.

Debra MacKenzie, Ph.D.

Research Assistant Professor, CNAEHER, University of New Mexico

Dr. MacKenzie, co-PI of the research project "Immune Dysregulation and Biomarkers of Autoimmunity of Tribal Communities Exposed to Mixed Metal Contaminants", received her Ph.D. from the University of New Mexico in Medical Microbiology and Immunology. Since then she has studied immune regulation and dysregulation following organ transplantation, viral infection and environmental exposures. She currently serves as Deputy Director of the Community Environmental Health Program at the University of New Mexico College of Pharmacy.

Mildred Maisonet, Ph.D., M.S.

Assistant Professor, CURE COPD Center, East Tennessee State University

Dr. Maisonet is an assistant professor in the Department of Epidemiology and Biostatistics at East Tennessee State University (ETSU) College of Public Health. She has worked at ETSU since 2014 in the biostatistics and epidemiology department. As an epidemiologist, she studies disease occurrence and its causes, and has used this information for disease prevention and control. Dr. Maisonet received a B.S. in biology and a M.S. in Epidemiology from the University of Puerto Rico. She earned her Ph.D. in Epidemiology from the Johns Hopkins University.

Meredith McCormack, M.D., M.H.A.

Assistant Professor, CURE COPD Center, The Johns Hopkins University

Dr. McCormack is an assistant professor of medicine at the JHU School of Medicine. Her areas of clinical expertise include asthma, chronic obstructive pulmonary disease, general pulmonary diseases and critical care medicine. Dr. McCormack holds a joint appointment in environmental health sciences at the JHU Bloomberg School of Public Health. She earned her M.D. from Jefferson Medical College of Thomas Jefferson University and her M.H.A from the Bloomberg School of Public Health. She completed her residency at Thomas Jefferson University Hospital and performed a fellowship in pulmonary and critical

care medicine at JHU. Dr. McCormack's research interests include asthma, chronic obstructive pulmonary disease, and environmental exposures and lung disease. She has been recognized with several honors, including a Loan Repayment Award for clinical research from the National Institutes of Health.

Claire Schollaert, B.A.

Community Engagement Core Coordinator, CRESSH, Boston University

Claire Schollaert is the Coordinator for the Community Engagement Core in the Department of Environmental Health at the Boston University School of Public Health. She assists CRESSH's community partners and Project 2: HOME investigators on the development of recruitment and educational materials for study participants, organizing workshops and meetings with our community partners, and website development and communications.

Nicolette Teufel-Shone, Ph.D.

Adjunct Professor, CIEHR, University of Arizona

Dr. Teufel-Shone has more than 30 years of experience with American Indians on community norms and behaviors related to food choice and physical activity patterns and the role in chronic disease prevention. She has formal training in nutrition, anthropology, and family and child health and serve as Academic Program Director of Family and Child Health at the Department of Health Promotion Sciences at the UA College of Public Health. Dr. Teufel-Shone is a past recipient of an NCI K07 award focused on the development of scientifically valid, culturally relevant methods to document food choices and activities in AIs. She has been actively engaged in community driven, community based intervention research and in 2009, published a seminal, systematic analysis of the peer reviewed and gray literature describing physical activity programs in Indian Country. Currently, she is the Co-PI of an NIMHD-funded P20 Exploratory Center of Excellence, entitled The Center for American Indian Resilience. She is Co-Director of the Research Core that provides formal mentoring to community-university research teams. She has published in the areas of qualitative data collection and analysis, community-based participatory research, community-based intervention efficacy and cultural adaptation. She is long-time member of the University of Arizona Cancer Center in the Cancer Prevention and Control Program.

Nicole Yuan, Ph.D., M.P.H.

Associate Professor, CIEHR, University of Arizona

Dr. Yuan is an associate professor in the UA Mel and Enid Zuckerman College of Public Health. She received a doctoral degree in clinical psychology from Bowling Green State University and an MPH degree in health services research from the University of Washington. She was a recipient of a K23 Mentored Patient-Oriented Career Development Award funded by the National Institute of Alcohol Abuse and Alcoholism that focused on interpersonal violence and substance use among American Indian tribes. She has also received funding for work on sexual violence education and prevention, tobacco cessation, indigenous environmental health, health literacy, integrative health, and community-based participatory research, with an emphasis on underserved populations. Her current research interests include adverse life experiences, interpersonal violence, coping and resilience, substance use, tobacco cessation, and community engagement in health promotion. Dr. Yuan teaches in the MPH degree program. Her courses include HPS 531 Contemporary Health Issues and Research and HPS 577 Sociocultural and Behavioral Aspects of Public Health. She mentors students at all levels. Nicole is a licensed psychologist in Arizona.

Appendix B: List of Participants

Gary Adamkiewicz, Harvard University

Hayley Aja, U.S. Environmental Protection Agency Student Services Contractor

Sandra Alvarez, University of New Mexico

Faith Baldwin, Blue Gap/Tachee Chapter, Arizona Navajo Nation

Tracy Bastain, University of Southern California

Paloma Beamer, University of Arizona

David Begay, University of New Mexico

Mae-Gilene Begay, Navajo Nation Division of Health

Monica Begay, Manuelito Chapter, New Mexico Navajo Nation

Priscilla Begay, Jeddito Chapter, Arizona Navajo Nation

Rachelle Begay, University of Arizona

Sadie Bill, Blue Gap/Tachee Chapter, Arizona Navajo Nation

Carrie Breton, University of Southern California

Maggie Breville, U.S. Environmental Protection Agency

Jeff Burgess, University of Arizona

José Cerrato, University of New Mexico

Karletta Chief, University of Arizona

Gwen Collman, National Institute of Environmental Health Sciences

Karen Cooper, University of New Mexico

Jonathan Credo, Northern Arizona University

Erica Dashner-Titus, University of New Mexico

Cherie DeVore, University of New Mexico

Ruofei Du, University of New Mexico

Genevieve Dunton, University of Southern California

Esther Erdei, University of New Mexico

Jorge Gonzales Estrella, University of New Mexico

M. Patricia Fabian, Boston University

Shohreh Farzan, University of Southern California

Symma Finn, National Institute of Environmental Health Sciences

Mae Franklin, Navajo Nation Cameron Chapter

Panagis Galiatsatos, The Johns Hopkins University

Frank Gilliland, University of Southern California

Melissa Gonzales, University of New Mexico

Rima Habre, University of Southern California

Nadia Hansel, The Johns Hopkins University

Robin Harris, University of Arizona

Wilfred Herrera, Laguna Pueblo New Mexico

Edith Hood, Red Water Pond Road/Church Rock Chapter, New Mexico Navajo Nation

Joseph Hoover, University of New Mexico

Laurie Hudson, University of New Mexico

Jill Johnson, University of Southern California

Carrie Joseph, University of Arizona

Jani Ingram, Northern Arizona University

Kee Kewanna, Red Water Pond Road/Church Rock Chapter, New Mexico Navajo Nation

Teracita Keyanna, Red Water Pond Road/Church Rock Chapter, New Mexico Navajo Nation

Francine Laden, Harvard University

Carol (CJ) Laselute, University of New Mexico

Ji-Hyun Lee, University of New Mexico

Michael Lerma, Northern Arizona University

Jon Levy, Boston University

Johnnye Lewis, University of New Mexico

Sylvana Li, U.S. Environmental Protection Agency

Andee Lister, Northern Arizona University

Nica Louie, U.S. Environmental Protection Agency

José Lucero, University of New Mexico

Li Luo, University of New Mexico

Debra MacKenzie, University of New Mexico

Kelley Maez, University of New Mexico

Mildred Maisonet, East Tennessee State University

Brian Mayer, University of Arizona

Shea McClain, University of New Mexico

Meredith McCormack, The Johns Hopkins University

Curtis Miller, University of New Mexico

Seraphina Nez, Blue Gap/Tachee Chapter, Arizona Navajo Nation

Helen Nez, Blue Gap/Tachee Chapter, Arizona Navajo Nation

Bertha Nez, Red Water Pond Road/Church Rock Chapter, New Mexico Navajo Nation

Liam O'Fallon, National Institute of Environmental Health Sciences

Jennifer Ong, University of New Mexico

Yoshira Ornelas Van Horne, University of Arizona

Mary Kay O'Rourke, University of Arizona

Brenette Pine, Navajo Nation Community Health Representative

Stephanie Carroll Rainie, University of Arizona

Nishadi Rajapakse, National Institute on Minority Health and Health Disparities

Jennifer Richards, University of Arizona

Paul Robinson, Southwest Research and Information Center

Karina Romero Rivero, The Johns Hopkins University

Joseph Runs After, Cheyenne River Sioux Tribe

Micheal Sayre, National Institute on Minority Health and Health Disparities

Jodi Schilz, University of New Mexico

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Chris Shuey, Southwest Research and Information Center

Neilroy Singer, Diné College

Becky Smith, University of New Mexico

Emily Szwiec, Association of Schools and Programs of Public Health (ASPPH)/EPA

Nicolette Teufel-Shone, Northern Arizona University

Claudia Thompson, National Institute of Environmental Health Sciences

Claudia Toledo-Corral, California State University, Los Angeles

Chrishirani Torres, University of New Mexico

Doris Tsinnijinnie, Red Mesa Chapter

Monique Tsosie, Tuba City Chapter, Arizona Navajo Nation

Shasity Tsosie, Baahaal Chapter, New Mexico Navajo Nation

Nicolle Tulve, U.S. Environmental Protection Agency

Lindsay Volk, University of New Mexico

Maira Welch, Tuba City Chapter, Arizona Navajo Nation

Sheldwin Yazzie, Albuquerque Area Indian Health Board

Duane Yazzie, Navajo Nation Shiprock Chapter President

Janene Yazzie, To Bei Nihi Dziil

Nicole Yuan, University of Arizona

Appendix C: Poster Abstracts

The views expressed in these abstracts are those of the authors and do not necessarily represent the views or policies of EPA. While many of these posters included multiple authors, only the lead presenters were requested in the call for abstracts and are listed here.

1. A Novel Method for Characterizing Resident Behaviors and Housing Attributes using Photo Survey

M. Patricia Fabian, Sc.D., CRESSH, Boston University
Zoe Petropoulos, Ph.D. Candidate, Boston University

Exposure to air pollutants such as $PM_{2.5}$ is associated with a variety of adverse health outcomes including cardiovascular and respiratory diseases, preterm birth, and low birth weight. Accurately capturing an individual's exposure to ambient air pollutants requires focusing on the indoor environment, as this is where the average person spends the majority of their day. The impact of resident behaviors (i.e., window opening or air conditioning use) on infiltration of air pollutants into a home has been well-characterized. However, efforts to accurately predict these behaviors and their distribution (through field campaigns and mail-in surveys) have many limitations, including the ability to characterize these behaviors across entire communities. Using the ArcGIS Photo Survey tool and a GPS-enabled camera, we collected photos of homes in a community in Massachusetts, and created an online survey which was used to classify open windows and installation of window air conditioning units via crowdsourcing. Photos are also linked to parcel-level housing data and neighborhood-level sociodemographic data which will be used to develop predictive models of these behaviors. In our winter 2016-17 survey, we captured photos of 1,100 homes and classified the necessary parameters using crowdsourcing for image classification. These data will be used to identify the significant predictors—including housing characteristics, sociodemographic variables, and meteorological parameters—of window-opening and ownership of window air conditioning units. This approach to data collection can be used to concurrently capture information relevant to community stakeholders—which may include data on recycling and trash bins, trees, blighted or damaged homes, and graffiti—and can be implemented in any community to collect a wide variety of information. Photo survey techniques can complement parcel data and other geospatial information to enhance residential exposure assessment.

2. Assessing Indoor $PM_{2.5}$ Concentrations in Households on the Hopi Reservation

Mary Kay O'Rourke, Ph.D., CIEHR, University of Arizona
Robin Harris, Ph.D., CIEHR, University of Arizona

Introduction: A significant proportion of the Hopi Tribe burn coal, wood, and other organic combustible materials for heating, lighting, and cooking in homes. An estimated 37 percent and 33 percent of Hopi household report burning coal and wood for heating, respectively. The Hopi Tribe has expressed their concerns about indoor air quality from the combustion of these fuels. The purpose of this pilot study is to measure indoor $PM_{2.5}$ concentrations in homes and assess the effects of fuel type and housing structure on indoor levels.

Methods: Pilot data was collected during the 2017 heating and non-heating seasons in households on the Hopi Reservation. Indoor concentration of $PM_{2.5}$ was measured over a 24-hour period using real time monitors set at 1-minute logging intervals. Subsequent collection of fuel type and housing characteristics was recorded by field team members at the time monitors were placed indoors. Average indoor $PM_{2.5}$ concentrations were calculated across household fuel types during heating and non-heating seasons.

Results: A total of 13 households have been sampled to date, of which nine houses have follow-up data during both heating and non-heating seasons, and four houses were sampled during non-heating season and are awaiting follow up. The indoor mean (SD) $PM_{2.5}$ concentration in 13 households was 24.6 (142.3) $\mu g/m^3$, and 38.2 (155.2) $\mu g/m^3$ and 15.6 (132.5) $\mu g/m^3$during heating and non-heating seasons, respectively. The mean indoor $PM_{2.5}$ concentration in households with coal and wood fuel use was 83.2 (255.3) $\mu g/m^3$ and

11.8 (35.2) µg/m^3 during heating and non-heating season, respectively. Electrical powered homes had concentrations of 13.3 (25.5) µg/m^3 and 27.1 (232.7) µg/m^3 during heating and non-heating season, respectively. Homes with a combination of electricity, coal and wood fuel use had indoor concentrations of 17.9 (36.0) µg/m^3 and 5.7 (13.2) µg/m^3 in heating and non-heating seasons, respectively.
Discussion: From this pilot study, households using coal and wood as primary fuel sources were found to have elevated indoor $PM_{2.5}$ concentrations compared to electrically powered homes. These initial results are similar to previous studies that found increased exposures and indoor $PM_{2.5}$ concentrations in households using combustible fuels as a primary fuel source. This project will continue to assess indoor air quality of households on the Hopi Reservation by various fuel sources and housing types during heating and non-heating seasons.

3. Characterization of Uranium Exposure in Sheep Grazing Near Abandon Uranium Mines

Andee Lister, Graduate Student, CIEHR, University of Arizona

During the Cold War era, uranium ore was mined on the Colorado Plateau, which overlaps with the majority of the Navajo Nation. There were various mining sites all across the Navajo Nation including Cameron, AZ, where open pit mining occurred. Our research is an investigation of uranium contamination of sheep on the Navajo Nation collected near Cameron. Navajo rely on sheep as part of their traditional diet and political economy. Consequently, the purpose of this research is to characterize uranium exposure and accumulation with respect to sheep grazing on or near abandoned uranium mine sites. The request to do this research was made from the communities of Cameron and Leupp. Collection of sheep organs and tissues was accomplished in collaboration with these communities. The sheep organs, meat/muscle, and bones samples were analyzed using an inductively coupled plasma mass spectrometry (ICP-MS). Initially, sheep exposed to uranium near the mine sites in Cameron was compared to a control group that graze in areas that were not mined (Leupp, Arizona). Statistically, the results indicate there were relatively similar levels of uranium in the meat and soft tissue of sheep from Leupp, and Cameron. Consequently, Leupp and Cameron will be compared to an additional control site off the reservation from Eager, Arizona. The results will be used to develop policy for the Navajo Nation with respect to contamination of traditional foods.

4. Community Driven University Partnerships to Assess Exposures and Risk Perceptions of Diné Communities following the Gold King Mine Spill

Paloma Beamer, Ph.D., CIEHR, University of Arizona

On August 5, 2015, three million gallons of acid mine drainage was released from the Gold King Mine, eventually reaching the San Juan River – the lifeblood of the Navajo Nation. This talk will share the experiences of building community and university partnerships to quickly develop and implement a community-based risk assessment in the wake of this environmental disaster. Central to this effort has been the development of a network of Diné community partners from the affected chapters that have guided the university researchers in designing and implementing a culturally appropriate study that addresses the community's concerns. A key focus has been on building capacity for assessing environmental exposures through training of Diné tribal college students, environmental interns, and community health representatives. To date more than 40 students (half Diné) and 25 community members have collaborated and participated in data collection, interpretation, and dissemination. Given the potential for future catastrophic mine spills in the Western U.S., findings will be used to develop a model of community capacity-building aimed at empowering affected communities to collect samples, minimize impacts, and engage in informed-decision making.

5. Correlations Between Immunologic Alterations and Metal Exposure Within the Navajo Birth Cohort Study

Jennifer Ong, Doctoral student, CNAEHER, University of New Mexico

The Navajo Birth Cohort Study was established to address community health concerns about chronic exposure to mine waste. Tribal populations are characterized by health disparities, including infection, kidney function, diabetes, and cancer. Based on past and ongoing work with Navajo Nation and other tribes, we hypothesize that chronic low-level environmental exposure to metal mixtures from mine waste results in immune dysregulation. In this study, we are examining whether changes in lymphocyte phenotypes can be seen in participants who have evidence of exposure to uranium, arsenic, manganese, and cadmium. Samples of blood and urine were collected from participants and analyzed for metals. Biomonitoring revealed an upward shift in blood manganese (BMN) and urine uranium (UUR) in the study population compared with the U.S. population as a whole (NHANES data). Urine total arsenic (UTAS) and urine cadmium (UCD) in NBCS participants is comparable or lower than NHANES data. Whole blood samples were used for immunophenotyping to identify total lymphocytes (CD45), T cells (CD3), T helper (CD4), T cytotoxic (CD8), NK (CD16CD56), and activated (HLA-DR) populations by flow cytometry. Univariate and multivariate analyses (n=80 samples) demonstrate associations between BMN and total lymphocytes. UTAS is associated with changes in the percentage of CD45, CD3, and CD16CD56 subsets. UCD is associated with alterations in CD3, CD16CD56, CD8, and HLA-DR+ subsets. While some metals may increase the percentage of a specific lymphocyte population, other metals may decrease that population, confirming the necessity of modeling the effects of metal mixtures rather than merely single exposure. It is important to understand the relationships between chronic metal exposure and immune alterations to better understand the potential health effects related to this exposure.

6. Criteria Air Pollution Monitoring for Particulate Matter on the Hopi Reservation: Site establishment and preliminary data collection

Mary Kay O'Rourke, Ph.D., CIEHR, University of Arizona
Robin Harris, Ph.D., CIEHR, University of Arizona

Little air quality data has been collected on reservations in Northern Arizona. The Hopi Tribe is interested in air quality assessment to evaluate the impact of regional coal burning power plants and local household burning of wood and coal on ambient air quality. The combination of regional, local and indoor combustion may influence the self-reported asthma rate (25.5 percent) experienced by tribal members. As part of our larger study examining health disparities, we have installed a TEOM 1405-DF to monitor regional PM at the Hopi Mission School in Kykotsmovi, Arizona. The Hopi value knowledge and have concerns about the impact of air quality information on traditional practices. Construction of the site began with leveling the site and pouring the concrete pad in August 2016 following approval of the tribal resolution granting permission for the study. In September and October, the container, electricity, back-up power and TEOM were placed at the site. Operation of the site began on October 28, 2016. Adjustments were made in November of 2016. Preliminary winter data indicate that ambient concentrations of $PM_{2.5}$ range from 1.9 to 5.3 $\mu g/m^3$. Coarse particulate matter (PM_{10}) ranges from 0 (during rainstorms) to 8.0 $\mu g/m^3$. Diurnal patterns of typical clear days show the highest concentrations of both PM_{10} and $PM_{2.5}$ during night time and lowest values during the late afternoon. These are only preliminary results. By contrast measurements of $PM_{2.5}$ in a short duration trial assessment reached 30.1 $\mu g/m^3$ inside a home operating a coal fired stove. As the project progresses we expect to find social and cultural factors impacting behavior and resulting in exposures that may impact health.

7. Cumulative Exposure Effects: Expanding research with the Hopi Tribe

Mary Kay O'Rourke, Ph.D., CIEHR, University of Arizona
Robin Harris, Ph.D., CIEHR, University of Arizona

The "Hopi Environmental Health Project" is a component of the newly funded Center for Indigenous Environmental Health Research (CIEHR) aimed at eliminating environmental health disparities. The Hopi Project objectives include: (1) Characterization of the magnitude of environmental exposures to particulate matter (PM), arsenic species, uranium and other contaminants from air, water, and food in households; (2) Evaluation of exposure moderation social determinants of health, social capital, and community resilience; and (3) Expansion of the Hopi Tribe's capacity to address areas of environmental concern that can inform programs and policy. Based on earlier survey work with the Tribe, the research team identified tribal health concerns addressing asthma and diabetes prevalence, while the Hopi Environmental Office indicated the need for ambient PM sampling, a concern regarding solid waste/ash disposal, arsenic in the water, and impact of contaminated water on people and crops. Self-reported asthma on the Hopi reservation affects 24 percent of the people as compared to a national self-reported asthma rate of 10.5 percent. This represents a clear health disparity that may be associated with housing type (traditional/stone masonry; "modern"/primarily block; and manufactured) combined with use of wood (38 percent) and coal (35 percent) to heat homes from late October through early April. Over the three years of the project 90 homes will be sampled for PM_{10} and $PM_{2.5}$ by operating a PDR 1500 Personal Data Ram for a 24-hour period during the heating and non-heating season. Water samples, dietary information and surveys describing behaviors will be evaluated. Homes will be selected with replacement by randomizing members listed on the tribal roles, characterizing homes by construction and heating mode and filling a grid defined by housing type and heating fuel utilized. The Hopi Environmental Protection office has identified other concerns related to homes. These include ash disposal, arsenic in drinking water, moisture/mold problems in homes, as well as radon and formaldehyde within buildings. These concerns will be ranked by the Community Advisory Board for analysis in conjunction with PM. Household sampling will begin in late October of 2016. This describes the background, rationale and study design proposed to evaluate environmental health disparities experienced by the Hopi Tribe of Arizona.

8. Development of a Low-Cost In-Home Air Pollutant Sensor Platform: Framework for selection and quality control

Gary Adamkiewicz, Ph.D., M.P.H., CRESSH, Harvard University

The measurement of air pollutant concentrations at various spatiotemporal scales can serve many purposes including: regulatory compliance, exposure assessment, epidemiology, as well as community-level and personal decision-making. The characterization of environmental exposures has always been shaped by logistic, technological, and financial constraints. Recent advances in the availability of portable and affordable devices that measure noise, thermal conditions, and pollutant concentrations have provided new opportunities to re-cast the landscape of exposure assessment as it is used to serve various goals. We can now continuously monitor for many pollutants of interest, including NO_2 and $PM_{2.5}$ using small, inexpensive, real-time monitors. While these monitors have existed for some time, only recently have they been developed for pollutants such as $PM_{2.5}$ that meet basic criteria for accuracy and precision at a price that would allow for sampling at a community-level scale. We have strong interest in understanding household-level disparities in key environmental exposures through our Center for Research on Environmental and Social Stressors in Housing across the Life Course (CRESSH) and are using such sensors toward achieving these goals. This poster will present an overview of our design process for our novel real-time sensor

package, called 'emma' (Environmental Multipollutant Monitoring Assembly). We developed this multipollutant real-time monitoring box for our Home-based Observation and Monitoring Exposure (HOME) study, the goal of which is to develop and implement innovative methods to provide improved estimates for between-household variability in environmental exposures. We are using these measurements to identify the key determinants (among activity patterns, temperature, source usage, ambient pollutant concentrations, and air exchange rates) of indoor exposure to key air pollutant stressors (e.g., $PM_{2.5}$ and nitrogen oxides (NO_x)) within small spatial scales, to best characterize drivers of exposure disparities and to directly inform objectives for future mitigation at the household level. Our study is focused within two environmental justice communities in the greater Boston area: Chelsea and Dorchester, Massachusetts. In this poster, we describe the process of selecting, validating, and calibrating these sensors over the first year of our study and provide guidance for other groups – including research institutions, community groups and/or citizen scientists – who might seek to develop and deploy such platforms.

9. Dot-Voting as a Method for Rapid Feedback from Tribal Community Members

Erica J. Dashner-Titus, Postdoctoral Fellow, CNAEHER, University of New Mexico

Feedback from community members is one of the key principles of community centered research projects. Ideally feedback should promote co-learning between researchers and community partners, allowing for a reciprocal transfer of knowledge. The collaborative partnership should be integral to every aspect of the research process. Traditional approaches for gaining community member feedback include surveys and interviews, among others. Surveys allow for anonymity but generally constrain participant responses and the transmission of feedback is solely unidirectional. On the other hand, community member interviews permit individuals to expound upon their responses but some may feel uncomfortable, as there is less anonymity. We presented a poster at the Laguna Open House meeting, September 6, 2017. The goals of the poster were two-fold: 1) to convey the overall goals and intents of the research projects in a nontechnical manner, and 2) to pilot a potential mechanism for gathering feedback from tribal community members. Community participants visiting the poster were offered a strip with six colored dots and encouraged to distribute the dots to indicate importance of broad research questions encompassed by Center research projects. The dot-voting method permitted individuals to leave feedback anonymously either in the presence or absence of the poster presenter. This method was found to facilitate communication, with many community members electing to share why certain research questions were important. Of the 40-50 community members present at the Laguna Open House meeting, we gathered feedback from approximately 10 individuals who indicated their research question priorities. These responses will be compared with those at future community events to inform and shape future research priorities.

10. Ecological Momentary Assessment Methods to Measure Stress, Mood, and Weight-Related Behaviors in Low-Income, Hispanic, Post-Partum Women

Genevieve Dunton, Ph.D., M.P.H., MADRES Center, University of Southern California
Sydney G. O'Connor, NHLBI Predoctoral Fellow, MADRES Center University of Southern California

Background: Excessive gestational weight-gain and post-partum weight retention are associated with an increased risk of lifelong obesity and chronic disease; additionally, sub-optimal weight gain and retention disproportionately affects women of minority groups and of low socioeconomic status (SES). The dynamic and real-time properties of EMA methods provide potential for gaining insight on the social, environmental, and contextual factors influencing weight-related behaviors and obesity risk during this critical time period. Despite this, use of EMA methods in Hispanic, low income, post-partum women caring for young infants may present a number of unique challenges, including concerns over participant burden and competing time demands. A pilot study was conducted to assess the feasibility of using EMA methods in post-partum women enrolled in a hospital-based birth cohort study.
Methods: A total of n=12 Hispanic women (58 percent Spanish primary language), with a mean age of 31 years (SD: seven years, range: 21-44), mean infant age of 19 weeks (SD: 8.25 weeks, range: 6-31 weeks), completed the study procedures. Trained researchers conducted home visits, where participants provided informed consent, were assessed for anthropometric measurements, and were trained on the use of the mobile phone application, and several other personal sampling devices. Over the following four days, participants completed up to five randomly prompted EMA surveys per day reporting on stressors, mood, and weight-related behaviors. EMA compliance and descriptive results from EMA surveys were assessed.
Results: Overall EMA compliance was 82.05 percent (range: 0 – 100 percent) of all available surveys. EMA survey responses revealed "tension with children", "work at home", and "demands made by family" to be significant sources of stress, reported in 25.55 percent, 15.38 percent, and 10.65 percent of all surveys, respectively. Participants reported consuming "Fruits or Vegetables" in 17.75 percent, "Pastries, Pan Dulce, or Sweets" in 13.02 percent, "Chips or Fries" in 5.92 percent, "Fast Food" in 5.33 percent, and "Soda or Energy Drinks" in 4.14 percent of prompts. While participants reported past 2-hour "TV, Videos, or Video Games" in 44.38 percent of all prompts, engagement in "Exercise or Sports" was reported in only 1.78 percent of prompts.
Discussion: This pilot study provides preliminary evidence that EMA methods can be effectively applied to the high-risk population of Hispanic, low SES post-partum women with young infants and high competing time demands. Results will help to inform future studies investigating the role of social, environmental, and contextual factors in post-partum weight retention and its associated health outcomes.

11. Environmental Toxic Metals Exposures Across Disproportionately Impacted Communities

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Exposures to toxic metals, such as lead, arsenic, manganese, and cadmium, continue to be of public health concern. Potential sources of multiple metal exposures including food, drinking water, and industrial contamination have been described among low-income communities of color, as well as Native American tribal communities, but to date, these exposures have not been well characterized in these populations. Our work has begun to characterize biomarkers of metals exposures among participants in a primarily low-income Latina pregnancy cohort, the Maternal and Developmental Risks from Environmental and Social stressors (MADRES) Study. We measured 33 elements in 1st trimester hair samples collected from a subset of 41 MADRES participants, and observed detectable levels of 17 of these elements in all participants,

including several contaminants of concern, such as arsenic, manganese, and lead. Analyses of metals in 103 urine samples collected over pregnancy (73 1st trimester, 30 3rd trimester) suggest recent low to moderate levels of exposure to arsenic, and relatively low-level exposure to cadmium and manganese, as compared to other U.S. populations. Comparison of MADRES urinary metals to those of rural Native American communities participating in the University of New Mexico Environmental Health Disparities Center suggests understanding sources of exposure may be important in characterizing risks across health disparate populations. This approach will help to improve our understanding of the contribution of these harmful exposures to environmental health inequities.

12. Evincing a Parlous Legacy: Elemental contamination of Navajo water

Jonathan Credo, Graduate Student, CIEHR, University of Arizona

During the Cold War the Navajo Reservation produced the largest supply of both raw and processed uranium ore to enable the United States' glut of nuclear munitions. Although uranium mining ended in the 1980s, the effects of the mining had a legacy on the people and the landscape. Increased deaths associated with lung and kidney cancers, ended a whole generation of Navajos who worked in mining, refining, and transporting uranium. In an attempt to rectify these issues, a small subset of the larger mines were closed and remediated to stem the danger posed to the surrounding communities. However, research is demonstrating that other contamination outside of the primary mine can result from mining activities. These contaminants can leech into ground and surface water systems, be carried by the wind to new distant sites, and have detrimental health effects on a population. This study seeks to identify and quantify these other possible elemental contaminants that may exist in unregulated water systems. Inductively coupled plasma mass spectrometry (ICP-MS) and inductively coupled plasma optical emission spectroscopy (ICP-OES) techniques were used to accurately detect these contaminants within water samples. Because all samples are collected from water sites labeled as "unregulated," there is no legal obligation to regularly monitor these sites or warn communities of any dangers that may exist due to contamination. The research demonstrated that a large proportion of the sites sampled exceeded the EPA's recommended maximum contamination level in one or more of the elements analyzed. The research demonstrated that these other contaminants are more ubiquitous than uranium, and potentially pose a larger threat. All information gathered from this study has been shared with communities affected to educate them of the dangers associated with these water sites.

13. Health and Well-being Impact of Contamination on Traditional Food on Navajo

Tommy Rock, Doctoral Candidate, CIEHR, University of Arizona

The project goal is to determine health risks and community impacts (e.g., consumption issues, threats to cultural values, spiritual concerns, and public health impacts) from exposure to environmental uranium and arsenic contamination of traditional food and water for Navajo communities. The approach for this project is to utilize a community-engaged research model to explore exposure pathways and to identify culturally applicable and community-constructed models for mitigation of the impact of the identified chemical contaminants on Navajo communities. The Specific Aims of the project are to: 1) characterize the extent of metal contamination in culturally significant food and water sources for two Navajo communities; 2) model dietary metal exposure and utilize the Indigenous Health Indicator to assess health impact; and 3) develop a Community-Participatory Multi-Level Policy Intervention Model. The policy work is being done in consultation with the Navajo Traditional Knowledge Holders to best shape policies around traditional food consumption.

14. Increasing Diversity in the Environmental Health Workforce

Claudia Toledo-Corral, Ph.D., M.P.H., MADRES Center, University of Southern California

Environmental Health disparities are strongly associated with both economic and ethnic health disparities seen in existing and emergent health outcomes including asthma, obesity, and cancer. Dissemination of public health preventive measures to diverse communities increasingly requires a well-trained and diverse workforce. Currently, undergraduate students belonging to certain ethnic groups are especially underrepresented in the Environmental Health fields, as are economically and socially disadvantaged people. Our goal is to increase participation in Environmental Health careers by recruiting and training a diverse pool of students from California State University Los Angeles (CalStateLA), a Hispanic-serving and minority-serving institution. "Eagles RISE" (Eagles in Research Internship and Service in Environmental health disparities)", is our joint CalStateLA/USC undergraduate internship program with a focus on Environmental Health. The primary goal of Eagles RISE is to increase racial/ethnic diversity in the workforce and/or in graduate programs in Public Health. Currently we are in the second year of the program. All interns in the pilot were first generation college students, had a GPA of 3.0 or greater, and displayed interest in community-based practice or research in environmental health issues. Internship experiences varied from 15-30 weeks long, based on student preference and each intern completed between 180 or 360 hours of fieldwork/academic work in order to receive three or six semester units of credit, respectively. Student intern projects varied and included components such as: community-based education modules on environmental toxins, participation in environmental health fairs and conferences, development of research survey tools, data entry and basic statistical data analysis, and overall exposure to research protocol related to cohort studies associated with the MADRES study. All interns have completed or are slated to complete a B.S. degree in Public Health from CalStateLA. In addition, they have all either applied or secured a job position or graduate school admission to a Public Health or health related field. These achievements of the first cohort of graduating interns are evidence the positive impact of a formalized internship program in environmental health disparities in a diverse group of students.

15. Investigation of Arsenic Mobility and Reactivity Near Abandoned Mine Wastes in Cheyenne River, South Dakota

Cherie De Vore, Ph.D. Candidate, CNAEHER, University of New Mexico

The contamination of arsenic and co-occurring metals in surface water and sediment has occurred due to mining legacy conducted across the Western United States near Native American lands. From the late 1800's into the mid-1950s, gold mining and the production of milling wastes upstream of the Cheyenne River Sioux Tribe (CRST) at Lead, South Dakota resulted in discharge of mine wastes into the Cheyenne River Basin and community members have expressed their concerns for the millions of tons of mine waste released into their primary surface water source. Because of the known health impacts of arsenic, mercury, chromium, and other co-occurring heavy metals, we need to investigate their concentration and speciation within stream sediment, stream water and ubiquitous plants to determine the extent of heavy metals contamination in areas used by Native American communities exposed to mining legacy waste material. This study seeks to understand the release of arsenic and potential mechanisms for mobility with the arsenic and iron-bearing solids found in the Cheyenne River. The highest concentrations of acid-extractable arsenic measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) from solid samples in the Cheyenne River bank collected in June 2016 at Deal Ranch (DR) were in the range of 259-386 mg/kg. Closer to the Homestake Mine on Whitewood Creek (WW), As concentrations in the sediment were as high 2020 mg/kg. Similar mineralogy between the DR and WW samples was identified through XRD analyses, with the

predominance of alumino-silicate and iron-bearing minerals. A batch experiment reacting these sediments (DR, WW) with phosphate (0.1 and 10 mM) and bicarbonate (0.2 mM and 20 mM) under environmentally relevant pH conditions suggested that arsenic is mostly (>90 percent) released as As (V). The mobilization of arsenic (V) with the bicarbonate treatment was 17 µg/L, however the highest release (6234 ug/L) occurred with 10 mM sodium phosphate (Na3PO4) treatment. Furthermore, a decrease of 16 percent arsenic (V) and 12 percent iron (II) was detected from both solids using X-Ray Photoelectron Spectroscopy (XPS) after being reacted with sodium phosphate. These results indicate that arsenic release is favored after reaction of sediments by competitive ion exchange with 10 mM PO43- compared to 20 mM HCO3-. The results from this study aid in a better understanding of arsenic in surface waters affected by mining legacy. In addition, plant uptake of arsenic was investigated in Chokecherry plants collected along the Cheyenne River and minimal accumulation (<1 ug/L) was observed in all parts of the plants along the growing season (June 2017-September 2017). This effort is part of the Center for Native American Environmental Health Equity Research's environmental monitoring core's specific aim to quantify environmental exposures to metals resulting from traditional and cultural practices. The overall goal of this research is to determine the chemical composition and mobility of arsenic in sediment and surface water near abandoned mine wastes from sites located along the Cheyenne River in South Dakota. This study serves as a foundation to build an interdisciplinary partnership with tribal community members, and to understand the broader impacts of mining on human health and the environment. Characterizing the spatial distribution of metals in the CRST environment may help to address community concerns about exposure and subsequent risk reduction strategies.

16. Land-Use Regression Models of Parcel Level Intra-Urban Surface Temperature in Three Cities in Massachusetts

M. Patricia Fabian, Sc.D., CRESSH, Boston University

Surface temperatures have been shown to vary substantially at the intra-urban scale. Models are needed that allow fine-scale spatial predictions of exposure to surface temperatures to conduct intra-urban exposure assessment and health analyses. The aims of this work were to (1) develop land use regression models of surface temperature at the parcel level in three cities in Massachusetts; (2) explore the relative importance of spatial and temporal factors on intra-urban surface temperature; and (3) compare models between cities. Thermal imaging data were obtained during flyovers from winter 2014 – summer 2016. In each city, image data were available for >30 days over the study period, and were used to calculate mean parcel surface temperature. Parcel scale regression models were developed for each city and for warm and cool seasons. Independent covariates in land use regression models included land use classification, year built, property value, impervious surface area ratio, normalized difference vegetation index (NDVI), wind direction, wind speed, temperature, relative humidity, population density, and distance from major water bodies. Preliminary results indicate that regression models explained between 32 to 48 percent of the variability in mean parcel surface temperature. Proximity to major water bodies explained the greatest amount of the surface temperature variation in each city (adjusted-R2=0.11-0.28), with differential effects by season. Land use and NDVI explained an additional ~10 percent of the variation, but had considerable differences in magnitude and strength of association between cities. Significant housing predictors included year built and building value. Our models can be used to predict fine scale surface temperature based on land use, housing, and meteorology, expanding our understanding of the drivers of urban-heat islands and associated health effects.

17. Livestock Movement and Exposure to Abandoned Uranium Mine Waste in Cove Wash Watershed

Joseph Hoover, Ph.D., CNAEHER, University of New Mexico

Uptake of metals and radionuclides in livestock meat and organs is of great concern because livestock graze in areas with abandoned uranium mines and waste piles. The accumulation of uranium in livestock meat and organs that are part of the traditional Navajo diet has been observed previously. However, our ability to interpret concentrations of uranium and other metals in animal tissue, and thereby to assess potential human exposure and risk, is limited by our understanding of the source, mobility, and points of exposure for animals. To date there remains limited knowledge about how livestock behavior patterns influence exposure to mine waste. For members of the Cove Community (Cove Chapter, Navajo Nation) there remain unanswered questions about human exposure to uranium (and co-occurring metals and radionuclides) by consuming organs and meat from livestock that grazed in the Cove Wash Watershed that has 51 abandoned uranium mines. Members of the Cove Community have requested a study to investigate these concerns. In response to this request, researchers from the University of New Mexico are collaborating with researchers from Diné College and NAU to investigate human exposure to uranium (and co-occurring metals and radionuclides) via consumption of meat and organs that are part of a traditional Navajo diet. This project is an opportunity for researchers from the UNM Center for Native Environmental Health Equity Research and the UA Center for Indigenous Environmental Health Research to collaborate and address an environmental health issue of concern to a Navajo community. A targeted investigation of Bos taurus (cattle), Ovis aries (sheep), and Capra aegagrus hircus (goat) movement and grazing patterns is necessary to inform risk analysis for human exposure to metals and radionuclides from consumption (or other uses) of animal tissue. In this study UNM researchers will use geospatial technology to determine the frequency and duration of livestock grazing in proximity to abandoned mines and waste. Additionally, we will identify environmental and land cover factors that are associated with livestock grazing patterns and identify factors associated with metal and radionuclide accumulation in tissue. Addressing these questions will enable us to quantify and model livestock grazing on or near abandoned mine waste, better interpret inter-animal chemical uptake in tissue, calculate more accurate chemical transfer rates from animal tissue to humans, and inform a broader risk assessment of human exposure to metals and radionuclides in the Cove Wash Watershed.

18. Particulate Matter and Mortality: Modification of the association by personal and area level indicators of socioeconomic status

Francine Laden, Sc.D., M.S., CRESSH, Harvard University

Socioeconomic status (SES) is an important determinant of health, both directly and as a modifier of other determinants. We investigated the modification of $PM_{2.5}$ exposure related all-cause natural mortality risk, by personal characteristics, area-level Census SES indicators and measures of racial and economic segregation. We obtained geocoded mortality records from the Massachusetts Department of Public Health (n=527,208), and highly spatially and temporally resolved temperature and $PM_{2.5}$ predictions from satellite-based models (2001-2011). We examined the association between $PM_{2.5}$ and natural mortality using case-crossover analysis and assessed effect modification by individual and area-level characteristics. Each 10μg/m^3 increase in two-day average exposure to $PM_{2.5}$ was associated with a 1.32 percent [0.94 percent; 1.69 percent] increase in mortality risk. The risk was higher among decedents without a college education and older persons. None of the area-level measures modified the association among all available cases. However, in

stratification by age, the risk was modified by economic segregation and dissimilarity among younger ages (<65) and effects were stronger in block groups with higher percentiles of racial dissimilarity among ages ≥85 (5.93 percent increase, [3.03 percent;8.91 percent]). Census SES indicators did not modify the association in either of the age groups. Current levels of $PM_{2.5}$ are associated with increased daily deaths and personal characteristics and SES modify those risks. Neighborhood social stressors, which incorporate personal characteristics as well as the surrounding environment, were found to be stronger modifiers than neighborhood SES indicators.

19. Perceptions and Experiences of Environmental Health Risks among Latina Moms

Jill Johnston, Ph.D., MADRES Center, University of Southern California

Pregnant women and new parents are often targeted by public health campaigns to reduce environmental exposures to minimize risks. However, little is known about how new mothers perceive and experience environmental health risks. In Los Angeles, Latinas often reside in neighborhoods with higher pollution and fewer environmental amenities. This higher cumulative environmental risk may contribute to observed health disparities among Latino infants and children. Using qualitative methods, we explored the experiences and perceptions of new mothers as it relates to environmental hazards, pollution and toxins. We conducted in-depth semi-structured interviews in English of Spanish with Latina pregnant women or mothers with a child under three years. Interviews were transcribed and analyzed using qualitative software. 33 women participated in the interviews between August-November 2016, of whom about 20 percent were pregnancy at the time and 75 percent were born outside the US. Key themes were the community surroundings, health risks and the barriers to changing the environment. Generally, the environment was most frequently described as something absent of people or buildings. Most frequency concerns were tangible risks, such as odors, smoking or trash. The interviews further explored whether and how environmental health risk perception influence behaviors, particularly during pregnancy. Women most often mentioned individual behaviors, such as cleaning products or food, as ways to improve health. More than half expressed feelings that they lacked the power to change their exposures.

20. Proposal for Smoke-Free Public Housing: A review of attitudes and preferences from residents of multi-unit housing

Panagis Galiatsatos, M.D., CURE COPD Center, The Johns Hopkins University

Background: Public housing units are a source of secondhand smoking exposure, putting many individuals at risk for health-related effects from secondhand smoke exposure. A recent policy proposal to ban public housing smoking indoors has received much support, but it is unclear how certain affected groups, specifically smokers in public housing units, perceive such a policy.

Purpose: To review the literature on attitudes and perceptions of public housing unit tenants, dichotomized into non-smokers and smokers, towards an indoor tobacco-free public housing policy.

Data Sources: English-language articles identified through MEDLINE (Embase.com), CINAHL, ERIC, PsycINFO (EBSCOhost), PubMed, and Cochrane Library databases, published between January 1, 1960 and November 1, 2016 were searched for articles regarding attitudes, preferences and smoking ban enforcement on tobacco free public housing units.

Study Selection: Two reviewers independently selected studies that compared attitudes and opinions about smoke-free public housing units as well as studies reviewing the success of enforcement of smoke-free public housing policies. Studies were included if they were conducted in the U.S., the study population

included tenants of multi-housing units, and the study reported on the tenants' attitudes and preferences of smoke-free multi-housing units.
Data Extraction: A multistep process was used to assist in identifying appropriate articles. Two reviewers independently screened titles, then abstracts, and then full text for relevance.
Data Synthesis: We identified and included 14 articles that were published between 2003-2016. A total of 11,286 participants were included in these 14 studies, 2290 (20.3 percent) of whom were smokers. In brief, non-smoking policies, specifically within housing units, were heavily favored by non-smokers (majority surveyed) and were heavily opposed by current smokers (minority of those surveyed). The few studies that explored the attitudes beyond simply endorsing or opposing smoking bans identified themes that included secondhand smoke incursions, fear of harm from secondhand smoke, and desire to quit smoking.
Conclusion: Studies investigating attitudes and beliefs regarding public housing smoking bans largely represent the views of non-smokers and lack data regarding the barriers and concerns of tenants who do not support smoke-free policies. In order to implement smoke free public housing policies, more work is needed to understand the perspectives of all resident stakeholders, especially in regard to how to best implement such a policy.

21. Quantification of Diné Activity Patterns with the San Juan River in the Wake of the Gold King Mine Spill

Yoshira Ornelas Van Horne, Doctoral Candidate, CIEHR, University of Arizona

In August 2015, three million gallons of acid mine drainage was accidently released from the Gold King Mine, eventually reaching the San Juan River. The Diné (Navajo) people have a deep spiritual connection to the natural environment and rely heavily on the San Juan River for agricultural, spiritual and cultural practices. Only a recreational risk assessment (e.g., hikers, campers) was conducted before reopening the river. This does not reflect the reality of the Diné. Investigating how the spill has affected the Diné's interaction with the river is crucial to understating the potential long-term health impacts following the spill. No data existed for activity patterns of the Diné with the river that could be used to conduct a comprehensive risk assessment. Focus groups were used to identify interactions between the Diné and the river. A consensus panel of focus group facilitators agreed upon 42 unique activities between the Diné and the river. The activities were grouped into one of four distinct categories, livelihood, recreational, spiritual and ceremonial, and arts and crafts activities. The activities were included in a questionnaire to collect pre- and post- spill frequency and duration activity data. Within one year of the spill, Navajo Community Health Representatives administered the questionnaire to adults living on the Navajo Nation. The 59 adults reported engaging in a combined total of 409 activities, with each individual engaging in an average of seven years (Range: 0- 29) activities before the spill. After the spill the 59 individuals reported engaging in a combined total of 177 activities, with each individual engaging in an average of three years (Range: 0-23) activities. There was a 48.5 percent decrease in livelihood activities, a 64.7 percent decrease in recreational activities, a 64.7 percent decrease in spiritual and ceremonial activities, and a 13.4 percent decrease in arts and crafts activities. Whether or not environmental contamination from the spill persist in the river, the spill has clearly impacted the Diné interactions with the river. There is likely to be long-term social-mental impacts from the trauma of the spill.

22. Requirement of NADPH Oxidase Activity for Arsenic Inhibition of PARP-1

Lindsay Volk, Graduate Student, CNAEHER, University of New Mexico

Human epidemiological studies show a correlation between arsenic and ultraviolet radiation (UVR) exposure with respect to the development of skin cancer. Previous studies have shown that exposure to

environmentally relevant arsenic levels, particularly in conjunction with UVR exposure, results in oxidative damage to DNA and proteins via the generation of reactive oxygen species (ROS). However, arsenic and UVR generate ROS by different mechanisms, with evidence supporting arsenic induced ROS via stimulation of NADPH Oxidase (NOX). Additionally, it has been shown that exposure to arsenic can result in the inhibition of poly(ADP-ribose) polymerase-1 (PARP-1) activity, resulting in retention of DNA damage. Together, the evidence supports the hypothesis that arsenic hinders the function of specific DNA repair proteins, and consequently sustains DNA damage induced by UVR. To further elucidate the mechanism of arsenic co-carcinogenesis, it is necessary to determine the requirements for PARP inhibition and arsenic augmentation of UV-induced DNA damage via NOX. In this study, we used a selective inhibitor of NOX, apocynin, and a ROS scavenger, MnTMPyP, to determine the relative contribution of arsenic exposure on normal human neonatal epidermal keratinocytes (HEKn). The PrestoBlue viability assay was performed on HEKn cells to confirm non-cytotoxic concentrations. We found that treatment of HEKn cells with apocynin or MnTMPyP ablated arsenic-stimulated ROS measured by DCF staining, decreased PARP oxidation, and partially restored PARP activity. It is predicted that the partial restoration of PARP activity will decrease retention of UV-induced DNA damage augmented by arsenic with studies underway. Current analysis includes in vivo studies of DNA damage retention in arsenic exposed p91phox-/- mice. Due to the prevalence and severity of skin cancer, it is important to elucidate the mechanisms by which arsenic acts as a co-carcinogen in humans.

23. The Center for Research on Environmental and Social Stressors in Housing Across the Life Course

Jon Levy, Sc.D., CRESSH, Boston University

The primary objective of CRESSH is to understand and reduce environmental health disparities (EHDs) by conducting three fully-integrated research projects applying novel methods in epidemiology, exposure science, and cumulative risk assessment, with strong community engagement across the Center. We are focusing on multiple health outcomes across the life course with evidence for EHDs (birth outcomes, childhood growth rates, and cardiovascular mortality), across Massachusetts and in two low-income communities (Chelsea and Dorchester). CRESSH emphasizes the role of housing and the neighborhood environment, which can contribute to or modify exposures such as air pollution and temperature. We are developing novel geospatial data resources and developing constructs for housing, material hardship, neighborhood environment, and socio-demographics, which will inform multi-stressor epidemiological analyses. In addition, we are using innovative real-time monitors to estimate indoor exposures to multiple chemical and non-chemical stressors in Chelsea and Dorchester. Throughout the Center, we are using quantitative metrics to evaluate the presence of EHDs and we are simulating the benefits from hypothetical interventions. CRESSH includes strong bi-directional engagement with community partners and a pilot project program to develop junior investigators interested in studying EHDs.

24. The Role of Supplemental Zinc in Arsenic Induced Oxidative Stress Response in Immune Cells

Sandra C. Alvarez, Post baccalaureate Research Scholar, CNAEHER, University of New Mexico. Groundwater contamination by environmental metals is a global health concern. Proximity to legacy uranium mines is associated with toxic metal exposures, including arsenic. One mechanism of metal toxicity is metal-induced oxidative stress. Arsenic has been shown to induce oxidative stress in immune cells and we hypothesize that supplemental zinc will play a protective role against the effects of arsenic exposure because zinc has antioxidant properties. Oxidative stress can be measured by an up-regulation of key oxidative stress response genes. For these studies, human monocytes (THP-1) were exposed to arsenic (sodium arsenite) in the presence or absence of zinc (zinc sulfate) for four, six, and 24 hours. Cell viability was measured after

acute exposures and oxidative stress response markers Heme oxygenase-1 (HMOX1), superoxide dismutase [Cu-Zn] (SOD1) and catalase (CAT) were assessed by immunoblot analysis and RT-qPCR. Results from cell viability assays reveal no cytotoxicity of arsenic until treatments surpass 10 µM. Immunoblotting reveals dose and time dependent induction of HO-1 protein after six hours arsenic exposure, but zinc treatment does not indicate any antioxidant effects. In this study we detect transcriptional changes of oxidative stress response genes at non-cytotoxic doses of arsenic. Significant induction of HMOX1 was detected at arsenic doses near the EPA's maximum contaminant level of 10 parts per billion (ppb) for arsenic. Zinc supplementation did not show any antioxidant effects at a dose of 5 µM. Because abandoned uranium mines are prevalent in the western U.S., it is important to better understand the contributions of mining associated metals and metal mixtures exposures to oxidative stress response and to identify ways to combat these adverse effects.