Appalachian STATE UNIVERSITY BOONE, NORTH CAROLINA

The Journal Of The Blue Cross NC Institute For Health & Human Services

Blue Cross NC Institute for Health and Human Services: Leon Levine Hall of Health Sciences, Appalachian State University

Abstract

Welcome to our Inaugural Issue! The Blue Cross NC Institute for Health and Human Services (IHHS), housed administratively under the Beaver College of Health Sciences, is one of only two institutes at Appalachian State University. The Vision of the IHHS is that it will be the preeminent vehicle for connecting university resources to community needs for the promotion of health and wellness research, clinical training, and outreach in Western North Carolina. As our vision states, "We aspire to create a community of learning—or regional classroom—wherein all community members are engaged with Appalachian in the process of learning, training students, seeking new knowledge, and directing the future of a healthy and prosperous region."

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Sustainable Health

Sustainable Health

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IHHS

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BLUE CROSS NC INSTITUTE FOR HEALTH AND HUMAN SERVICES

Beaver College of Health Sciences

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Welcome to our Inaugural Issue! The Blue Cross NC Institute for Health and Human Services (IHHS), housed administratively under the Beaver College of Health Sciences, is one of only two institutes at Appalachian State University. The Vision of the IHHS is that it will be the preeminent vehicle for connecting university resources to community needs for the promotion of health and wellness research, clinical training, and outreach in Western North Carolina. As our vision states, "We aspire to create a community of learning—or regional classroom—wherein all community members are engaged with Appalachian in the process of learning, training students, seeking new knowledge, and directing the future of a healthy and prosperous region."

Achieving our mission and vision, by definition, would not be possible without the willingness of the extraordinary men and women who serve our communities in their respective organizations across the region to open their arms to our faculty, staff and students who want to learn with them, train with them, and create new knowledge and new opportunities collaboratively. The purpose of this journal is to address the most salient regional problems and opportunities surrounding health and wellness in Western North Carolina and highlight the ongoing efforts of our regional collaborations to address these through research, outreach, education/training, and program development.

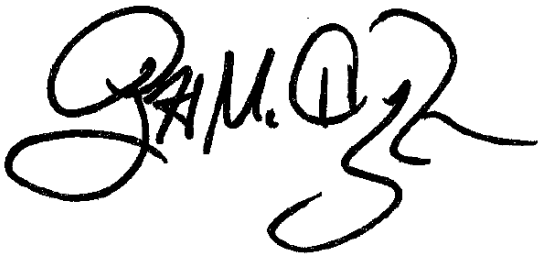
We chose the topic of Sustainable Health for this inaugural issue because sustainability is at the core of Appalachian State's mission, and we believe that it is critical to define what sustainable health is and explain why it must be a significant part of the ongoing discussion and agenda addressing sustainability. It was one year ago that we began the process of shutting down most of the planet over a new coronavirus. If anyone needed a reminder of how we are all dependent upon one another for sustainable health, that should have served the purpose. Then there are the underlying aspects of a disease entity such as this--how people with lower incomes, less access to health care, inability to socially distance from others due to employment or living conditions, and other factors were more likely to contract the virus, more likely to suffer morbidity and mortality, and less likely to receive adequate support.

But creating and maintaining sustainable healthy communities has been a challenging goal long before this virus and will be long into the future. It includes everything from the basics, such as clean water and sanitation, to education, access to adequate care, transportation, and sufficient amounts of nutritious food. Cultural, economic, and environmental factors are top among many others that play a role in the successes and failures surrounding sustainable health. Fortunately, there are researchers, educators, case workers, health and human service providers, and others working to address these factors at the local level with an eye toward global success.

In this issue, we offer six articles addressing sustainable health from different perspectives, including the very definition of it; mental health issues; hunger, poverty, and health; impact on aging; the importance of access to outdoor healthy activities; and climate and health. Our authors include Appalachian State faculty, as well as regional health and human service providers from Hospitality House of Northwest North Carolina, Mt. Vernon Baptist Church, Second Harvest Foodbank of Northwest North Carolina, the Hunger and Health Coalition of Boone, Appalachian Regional Health

System, Appalachian District Health Department, and the North Carolina Institute for Climate Studies. It's exciting to have these experts in the field and experts in the halls of academia working together to address our most pressing health issues, and I hope you enjoy reading about their efforts and gain some new insights into the complexities of creating sustainable healthy communities.

Special thanks to Dr. Adam Hege, who took extra time out of his very busy schedule to serve as the associate editor for this issue. His article does an outstanding job of defining sustainable health and laying out a framework that everyone can understand and appreciate. This would not have been possible without his support. Thanks also to the amazingly talented interdisciplinary faculty from across our university who contributed to this issue. They did so out of their true desire to impact change right here where we live. As a university, we want to provide hands-on training to students wherever possible; and it was a pleasure to have Justin Radulovich, a senior studying graphic design, put this issue together for us from start to finish. I think you'll agree that he did an outstanding job. Finally, thanks to the support of the Beaver College of Health Sciences from Dean Marie Huff and to Appalachian State University for supporting our ongoing efforts to educate the future health and human service workers of our region and create a sustainable, healthy planet.



Gary H. McCullough, Ph.D.
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Sustainable Health What is Sustainable Health (And Why You Need to Know)?

Adam Hege

"Our challenge, our generation's unique challenge, is learning to live peacefully and sustainably in an extraordinarily crowded world. Our planet is crowded to an unprecedented degree. It is bursting at the seams. It's bursting at the seams in human terms, in economic terms, and in ecological terms."

Currently, the world has a population nearing eight billion people, with projections for nearly 10 billion by 2050. Many questions and concerns persist regarding how we will manage limited resources and take care of humanity, all while not further degrading the natural environment. In 2015, world leaders came together at the United Nations General Assembly and reached agreement on 17 Sustainable Development Goals (SDGs) for moving forward on tackling the complex challenges facing the world. Each of the lofty goals has a focus on improving the health and wellbeing of citizens around the world, while pursuing a more equitable distribution of resources to include: ending poverty in all forms; eliminating hunger and food insecurity through sustainable agricultural practices; reducing social inequities (education, gender, racial, occupational, etc.); and addressing environmental concerns (land, water, consumption/production) associated with climate change, among others. Each of these 17 SDGs have direct impacts with western North Carolina and the Appalachia region as a whole and provide direction moving forward. In this paper, I examine what the terms 'sustainable' and 'health' mean for the 21st century, the numerous connections between sustainability and human health, and the short-term and long-term challenges facing western North Carolina and the Appalachia region, which are intricately connected to sustainability and health. Lastly, I present principles and approaches from the fields of sustainable development, community development, and public health, which are grounded in the SDGs, that communities should seek to utilize in moving forward in the 21st century.

Introduction

A major topic of concern over the past couple of decades has been 'sustainability'. So, what does the concept of sustainability, which is floated around in a multitude of professional and academic disciplines, actually mean? The term 'sustainability' has been debated for numerous decades and, in fact, there is no universally agreed way of defining it. However, in general, when we explore the term through reason, evidence and experience, it is essentially the many processes that are taken to maintain a certain level, for both the present and future.1 It can apply to all of the various aspects of our human lived experience. Regarding the human and non-human world in which we live, most refer to sustainability as the many interlinked components (environmental, social, economic, and institutional) making up the world, and how each of these resources can be maintained to meet our basic needs over time.[2,3]

The research pertaining to sustainability and sustainable development has centered on the three pillars: economic, social, and environmental. Or, as John Elkington first said and many continue to call it: profit, people, and planet.[4,5] The basic premise

and challenge is: how do we as humans maximize economic growth and development in a socially responsible, equitable and inclusive way that does not harm our planet and environment, all while seeking to improve human life? Moreover, the follow-up question becomes: how do we accomplish all of this with our world nearing eight billion people, the vastly different needs and desires across the world, and governments and policymakers within and across countries largely differing on how we achieve global sustainability? Effective public policy, however, is crucial to achieving this equilibrium and a more just, sustainable world.

These concepts of sustainability are vital to the health of the global population. Health, which is complex, is defined by the World Health Organization as a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."[6] One's physical and mental health and well-being is the result of the physical environment, social and economic opportunities and experiences, human and health behaviors, health care and medical resources, and public policy.[7] When we examine health from a population or public health lens, we recognize that each of the three primary pillars of sustainability are critical for human health. The field of public health seeks to protect and improve the health of populations and communities through public policy recommendations and advocacy, health education and outreach, and epidemiological research and was simply defined by the Institute of Medicine in 1988 as what "we as a society do collectively to assure the conditions in which people can be healthy."[8] While many in the western world, and in particular the U.S., view health as a primarily medical-oriented issue, research has shown that medicine and clinical care only accounts for roughly 20 percent of human health. In reality, 80 percent of health outcomes is due to social determinants of health (income/socioeconomic status, etc.), health behaviors (which are largely driven by social/environmental factors), and the physical environment (see Figure 1).[9,10] benefits of resilience planning in WNC.

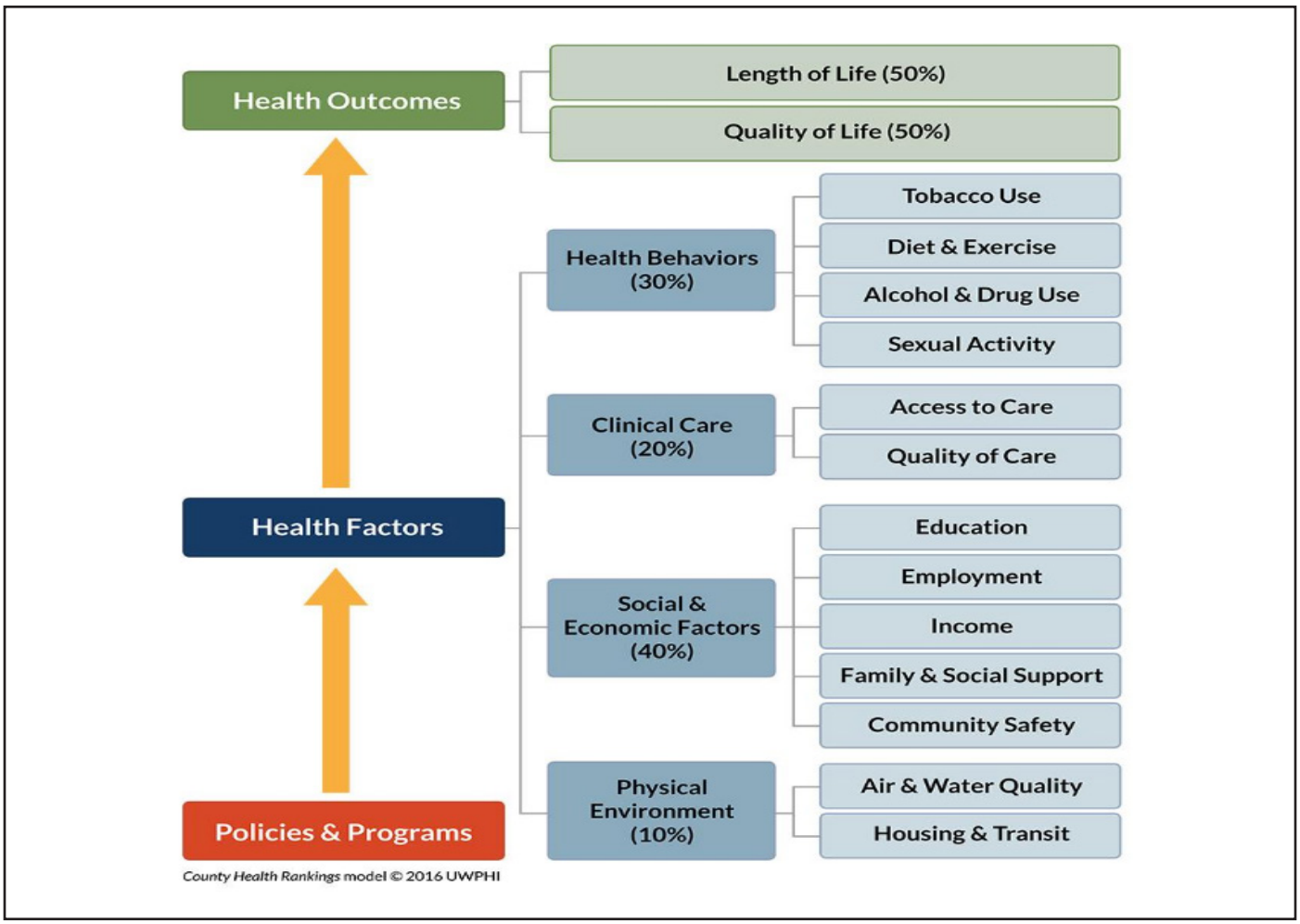
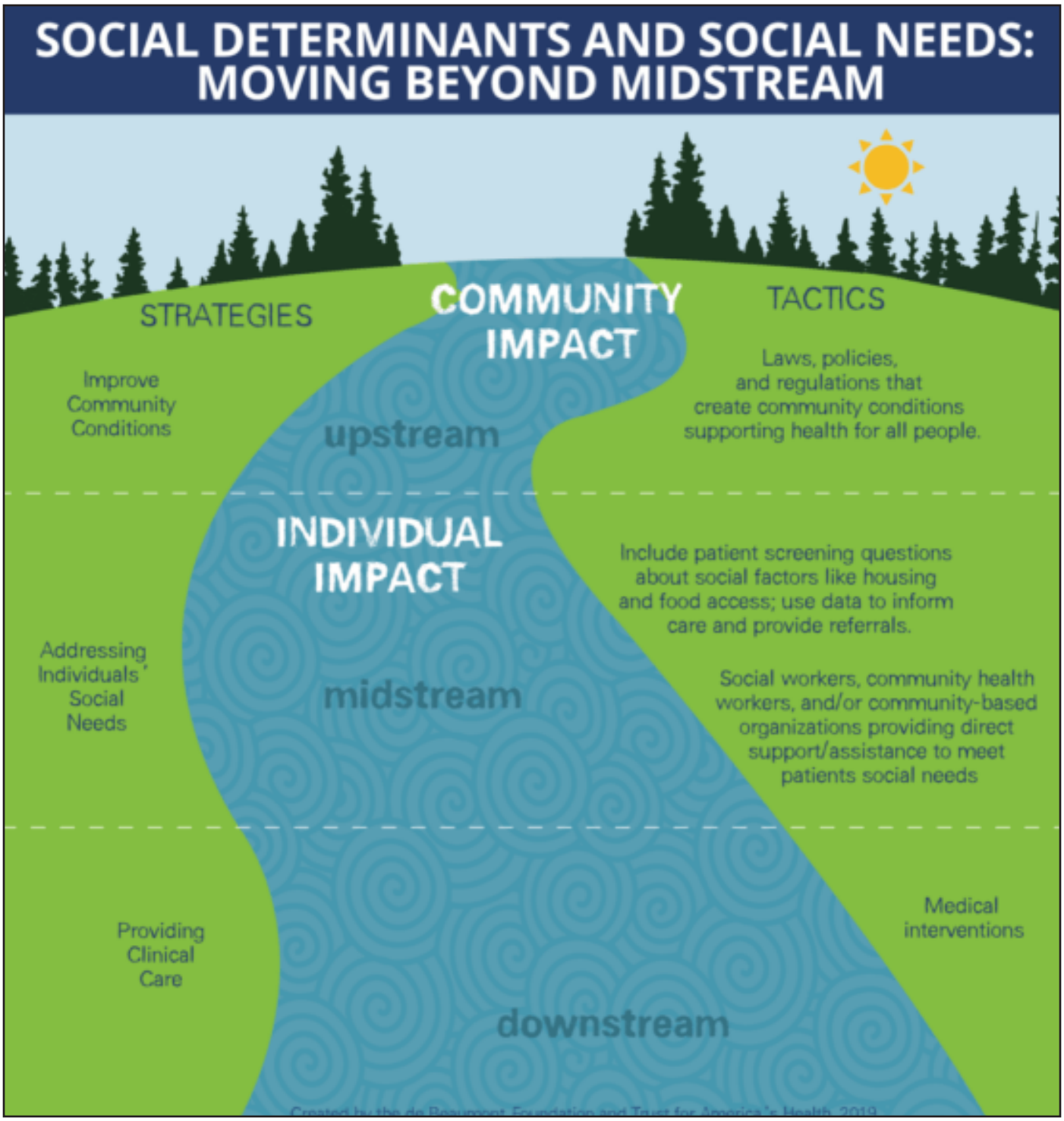


Figure 1. Determinants of health.

In the public health field, the 'stream' analogy (see Figure 2) of upstream, midstream, and downstream is often used to describe the determinants of health in relation to health outcomes, which is a visual representation of the 'driving forces' behind human health at both an individual and population level. The upstream impacts are the community and societal conditions (policies, laws, regulations); health promotion and social care (screenings, social work, behavior change) occur midstream; and, finally, clinical care and medical interventions are further downstream. In the United States, we spend the overwhelming majority of our budgets at all levels of government on the downstream factors and devote much less attention upstream and midstream; as a result, we spend a much greater percentage of our GDP on medical care than any other developed country and have among the worst health outcomes in return.[7,11]



When sustainability across all three pillars and an upstream public health approach is not the focus, the world and individual nations experience social, economic and environmental inequities that result in health disparities. Health disparities are defined by the National Institutes of Health as, "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups (including gender, race/ethnicity, socioeconomic status, occupation, disability, geographic location, or sexual orientation."[12] The disparities in health are not happenstance but are societal injustices and often considered issues of morality, ethics, and human rights.[12-14] As such, there have been many calls from the fields of sustainable development and public health for a human rights approach as it pertains to health. The right to health was declared a human right in the Universal Declaration of Human Rights of 1948.[15,16] With the substantial health disparities and inequities across the world, government leaders from around the world met in September 2015 to establish a 15-year set of 17 Global Sustainable Development Goals (SDGs) with 169 targets for addressing and improving the economic, social, and environmental pillars.[17]

The broad overarching goals of the SDGs are all interconnected and seek to provide a "shared blueprint for peace and prosperity for people and the planet, now and into the future."[18] As seen in Figure 3 below, the 17 goals consist of: eradicating poverty; ending hunger; achieving good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry innovation and infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and production; action on climate change; care of life below water; care of life on land; peace, justice and strong institutions; and partnerships for the goals. With the ambition of achieving these goals by 2030, countries around the world will have to make deep transformations in their policy agendas and the way financial resources are invested; in addition, it will require much data and science to inform solutions and to track progress.[19] Systems thinking and transdisciplinary approaches will be vital to the planning and implementation of policies and interventions across the SDGs.[20,21] A systems and transdisciplinary approach allows us to recognize the interconnections between all of the SDGs and social and environmental determinants of health and how interdependent each is on the other. In addition, it helps researchers and policymakers to account for the feedback mechanisms (both reinforcing and buffering) of the various factors involved.[22]

Figure 3. UN Sustainable Development Goals

With the SDGs being so complex, policymakers should seek multifaceted policies that address multiple goals simultaneously – one viable way, promoted by the public health field, is a health in all policies (HiAP) approach. This approach centers on the importance of public policy across all sectors (environment, social, economic, etc.) incorporating health and health outcomes in their decision-making.[23-25] In their 2019 paper, Sachs and colleagues[26] further provided a framework for countries to use as well as evidence-based examples to incorporate. Specific examples, among others, include: universal early childhood education; occupation-related social protections (living wage, anti-discrimination measures); expanded social safety net protections; universal health coverage; zero-carbon electricity generation; electrification and zero-carbon fuels; efficient and resilient agricultural systems; healthy food promotion/regulation; integrated land-use/water management; sustainable mobility and transport networks; and universal broadband internet access. Meanwhile, Fu's[27] group sought to simplify a similar systems approach that can be adapted to countries based on the surrounding context and addresses the 3C's: classification, coordination, and collaboration. Their framework recognizes that countries have different challenges and needs within their country – and, in addressing the SDGs at a global level, it is apparent that nations will have to work together.

The United States, just like other nations, has its unique contextual challenges rooted in the SDGs and one of the most consistent factors across the country is the role of place or geographic location. One specific region that gets a lot of attention for its worse health outcomes than the rest of the nation, is the Appalachian region.[28,29] The region includes 420 counties and spans 13 states, including the entire state of West Virginia.[30] Across Appalachia, much progress has been made over the last several decades, however, the Region still encounters lower incomes and higher poverty rates, high unemployment and underemployment rates, and lower educational attainment, when compared to the rest of the U.S, which are all critical upstream social determinants of health.[28] Concurrently, Appalachia performs worse on health measures to include, among others: physically and mentally unhealthy days; depression; mental health providers; obesity; physical inactivity; smoking; heart disease, cancer, and stroke mortality; healthcare access/primary and specialty care physicians; and years of potential life lost.[28] Moreover, the Appalachian region has been found to be experiencing drastically higher rates of "diseases of despair"[31] and ultimately "deaths of despair"[32], which are associated with the interconnectedness of economic challenges and income stagnation and mental health and substance abuse associated morbidity and mortality.

A major feature of Appalachia that is often identified as the root of the challenges are the high rates of rurality across the region. The Appalachian Regional Commission reports that 42 percent of Appalachia is deemed rural; whereas, only 20 percent of the national population lives in a rural setting.[30] However, research has found similarities in adverse health outcomes between rural and urban settings, with both doing worse than suburban areas.[33] Baciu and colleagues[34] suggest that rural areas tend to encounter distinctive characteristics that are associated with both the upstream factors and the health outcomes, which include: demographics featuring older populations, as younger populations generally move to cities for work and/or school; inefficiency in healthcare systems and the providing of services (hospital closures); evidence-based interventions and the allocation of governmental resources focused on urban areas; a lack of technological infrastructure; and place-based exposures and occupational risks.

To add to the mix of these challenges to sustainability and health, the world and U.S. currently finds itself in the worst global pandemic, COVID-19, that we've experienced in this generation. COVID-19 has forced us to examine many of these issues and has serious implications for our world moving forward. It has shown us that coordinated governmental action at all levels and collective action is needed when addressing society's most pressing social, health, environmental, and economic challenges that are all being brought to the forefront as a result of COVID-19.[22]

With this background and context, in the following sections I use the SDGs to provide a general overview of the challenges and opportunities facing Appalachia and provide recommendations. Along the way, I refer to the work presented by other authors in this volume and place an emphasis on western North Carolina and the High Country area. I provide some concluding remarks on how research and expertise from Appalachian State University can make a significant impact on improving the quality of

life in western North Carolina and beyond, through addressing the SDGs.

Overview of Sustainable Development and Public Health Challenges and Opportunities facing Appalachia and the High Country

It is recognized that each of the SDGs are inextricably linked and can either support or hinder the results of others. For the purposes of this paper, I have divided the SDGs into four categories to discuss the implications of each for Appalachia and specifically the High Country. The four areas include: social determinants of health/economic inequities; environmental determinants of health; governance/trust in institutions/assets/partnerships; and good health and well-being.

Social determinants of health/economic inequities

Across Appalachia, poverty and food insecurity and hunger are major issues. According to trend data from the 2014-2018 American Community Survey, the median household income across the region is 82.5% that of the U.S. general population ($49,747 vs. $60,293) and the poverty rate is 1.7% higher (15.8% vs. 14.1%).[35] Within those same data, however, it is found that Central and South Central Appalachia fare the worst, with the median household incomes being $36,993 and $46,669, respectively. The High Country portion of North Carolina (Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes, and Yancey counties), where Appalachian State University is located, falls within the South Central portion. When examining the recent Appalachian Health Disparities report[28], grocery store availability and food access are major barriers to health. Specifically, the report found that across Appalachia, there are 14% fewer grocery stores per 1,000 population when compared to the U.S.; and even more importantly, Southern Appalachia falls 24% lower than the national mark. When combining the economic issues and food accessibility and availability, the combination of increased poverty and food insecurity challenges are problematic and deserve much attention.

Specific to North Carolina, Roy and colleagues further found that the western North Carolina counties, which are located in South Central Appalachia, had a higher food insecurity prevalence, when compared to North Carolina as a whole.[36] When examining the High Country in the data from the 2020 County Health Rankings[37] found in Table 1, we see that median household income across the counties ranges from $39,700 to $48,500, all falling below the North Carolina average. An important note to make is that while Watauga County has a slightly higher income level, there is still great income inequality and disparity between the rich and the poor. Connected to the income data, across the counties (minus Watauga), there are much higher rates of childhood poverty, high levels of children eligible for free or reduced lunch, and increased levels of food insecurity. In their article in this volume, Gutschall[38] and her colleagues describe their work related to poverty alleviation and food insecurity/hunger in the High Country and the importance of community and academic university partnerships from Appalachian State University.

Additional Resources

https://www.hsph.harvard.edu/nutritionsource/sustainability/

https://www.paho.org/salud-en-las-americas-2017/?p=67

https://www.un.org/sustainabledevelopment/

https://www.ted.com/talks/michael_green_the_global_goals_we_ve_made_progress_on_and_the_ones_we_haven_t

https://www.youtube.com/watch?v=a5xR4QB1ADw

https://www.ted.com/talks/jude_wood_building_a_resilient_community

https://www.who.int/initiatives/decade-of-healthy-ageing

https://www.jeffsachs.org/

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Table 1. Social and environmental determinants of health and health outcomes across the High Country compared to state of North Carolina (2020 County Health.

	Alleghany County	*Ashe County*	*Avery County*	*Mitchell County*	*Watauga County*	*Wilkes County*	*Yancey County*	*North Carolina*
Demographics:								
Population	11,161	27,109	17,505	15,000	55,945	68,557	17,903	10,383,620
% below 18 years	17.4%	17.6%	15.0%	18.3%	12.8%	20.5%	18.3%	22.2%
% 65 and older	27.1%	25.7%	22.2%	24.9%	15.8%	21.6%	25.7%	16.3%
% White	86.4%	92.9%	88.5%	91.8%	91.6%	86.9%	92.2%	62.8%
% Black	1.6%	0.7%	4.4%	0.5%	1.7%	4.3%	0.8%	21.4%
% AI/AN	0.6%	0.4%	0.6%	0.9%	0.4%	0.4%	0.8%	1.6%
% Asian	0.8%	0.6%	0.6%	0.7%	1.2%	0.6%	0.3%	3.2%
% N Haw/PI	0.0%	0.1%	0.1%	0.2%	0.0%	0.1%	0.3%	0.1%
% Hispanic	9.9%	5.2%	5.2%	5.8%	3.7%%	6.8%	5.5%	9.6%
% Females	50.5%	50.9%	45.6%	50.7%	50.1%	50.8%	50.8%	51.4%
% Rural	100.0%	84.9%	88.8%	82.6%	55.4%	72.8%	100.0%	33.9%
Social & Economic Determinants:								
High School grad	92%	87%	94%	85%	90%	88%	92%	86%
Some college	43%	60%	55%	57%	78%	56%	58%	67%
Unemployment	4.5%	3.6%	3.6%	4.5%	3.5%	3.7%	3.6%	3.9%
Children in poverty	30%	26%	25%	24%	15%	32%	26%	20%
Income inequality (80^{th} percentile to 20^{th} percentile ratio)	4.4	4.5	4.4	4.6	6.9	4.9	4.4	4.8
Single-parent house	40%	34%	36%	26%	23%	30%	23%	35%
Median household income	$39,700	$41,900	$41,700	$44,000	$48,500	$44,100	$44,800	$53,900
Children eligible free or reduced lunch	65%	57%	58%	54%	34%	81%	51%	56%
Suicides (deaths per 100,000)	27	17	15	26	15	20	20	13
Environmental Determinants:								
Air pollution – particulate matter	8.7	8.5	8.5	8.5	8.3	9.6	8.6	9.8
Drinking water violations	Yes	No	No	No	Yes	No	No	--
Severe housing problems	13%	12%	13%	14%	26%	14%	13%	16%
Home ownership	75%	75%	75%	80%	61%	74%	74%	65%
Severe housing cost burden	13%	9%	14%	12%	20%	12%	11%	13%
Health:								
Premature death (death before age 75 per 100,000)	8,200	7,400	7,900	8,900	5,100	9,500	7,400	7,700
Poor or fair health	19%	16%	17%	16%	18%	18%	18%	18%
Poor physical days (last 30 days)	4.4	4.1	4.1	4.0	4.3	4.3	4.3	3.9
Poor mental health days (last 30 days)	4.4	4.1	4.1	4.1	4.6	4.3	4.4	4.1
Life expectancy	78.2	78.7	77.8	76.3	82.0	76.5	78.4	78.0
Frequent physical distress (≥14 days/month)	14%	13%	13%	12%	14%	13%	13%	13%
Frequent mental distress (≥14 days/month)	14%	13%	13%	13%	14%	14%	14%	13%
Diabetes	11%	17%	18%	17%	7%	14%	18%	11%
Smoking	17%	17%	17%	16%	18%	18%	17%	17%
Obesity	26%	26%	27%	27%	17%	43%	30%	31%
Food environment index (1-10)	8.0	8.1	8.4	--	7.3	7.6	8.1	6.7
Physical inactivity	26%	31%	29%	26%	19%	32.2%	31%	24%
Access to exercise opportunities	27%	59%	100%	100%	92%	74%	100%	74%
Excessive drinking	14%	15%	17%	16%	19%	15%	15%	17%
Food insecurity	14%	13%	12%	12%	17%	14%	14%	15%
Drug overdose deaths (per 100,000)	--	16	19	--	8	35	23	22
Insufficient sleep	33%	32%	31%	31%	32%	34%	30%	34%
Uninsured	18%	16%	20%	14%	14%	16%	15%	13%
Primary care physicians	920:1	2,250:1	3,510:1	1,670:1	1,340:1	2,450:1	1,480:1	1,410:1
Dentists	5,580:1	2,710:1	3,500:1	1,670:1	1,650:1	2,980:1	3,580:1	1,780:1
Mental health providers	450:1	600:1	240:1	1,250:1	250:1	530:1	530:1	410:1
Preventable hospital stays (per 100,000 Medicare enrollees)	5,181	3,937	3,948	2,077	3,281	4,837	1,807	4,758
Mammography screening	44%	44%	35%	42%	44%	48%	41%	46%
Flu vaccinations	53%	52%	47%	40%	52%	51%	37%	51%
Other primary care providers	1,860:1	1,291.1	1,945:1	600:1	1,036:1	1,224:1	1,194:1	801:1

While hunger and poverty are central issues across Appalachia and the High Country, other very pertinent social inequities that serve as root causes of health disparities include education/educational attainment, employment and workforce opportunities, and the impacts that each can have on both families and communities. According to the aforementioned Health Disparities in Appalachia report, the region experiences lower rates of post-secondary education; and the Southern and Central sub-regions experience even lower rates. Within the disparities are major differences between rural and urban areas; with the High Country being overwhelmingly rural, the rates are lower as well, particularly in the more rural counties. In addition, those living in rural areas often have to travel further for work and could experience transportation barriers, while also working in occupations that have limited income opportunities. Specific to the High Country, as found in Table 1, the counties tend to be much older in nature; and the younger populations tend to move away for work. While the high school graduation rates are fairly good across the counties, outside of Watauga County where Appalachian State University is located, there are relatively lower rates of some college attainment. Reed-Ashcraft[39] and her colleagues delve into the intergenerational impacts that these experiences can have on children throughout their lifespan, including mental health concerns.

Environmental determinants of health

Without doubt, the biggest global environmental health challenge facing the world, is climate change. The world's rapidly changing climate affects us all and can have major implications for infectious disease patterns, food insecurity and hunger, drinking water and air quality.[40] Much of this is driven by human behavior in the forms of energy we demand and consume and the importance of it to our economic development. As seen in Figure 4, climate change and the environment around us can have severe immediate or long-term and direct threats to human health, such as through natural disaster and extreme weather events (flooding, heat/cold, hurricanes, etc.), housing conditions, and air and water pollution, among others. These threats can result in health implications to include increases in injury risks, certain forms of cancer, heart and lung disease, and exacerbated challenges with mental illness. In addition, the conditions can make certain populations and geographic locations more vulnerable to the many health risks. This could include those with increased poverty rates and older populations, a limited infrastructure and capacity for prevention and mitigation efforts, and other underlying social inequities.

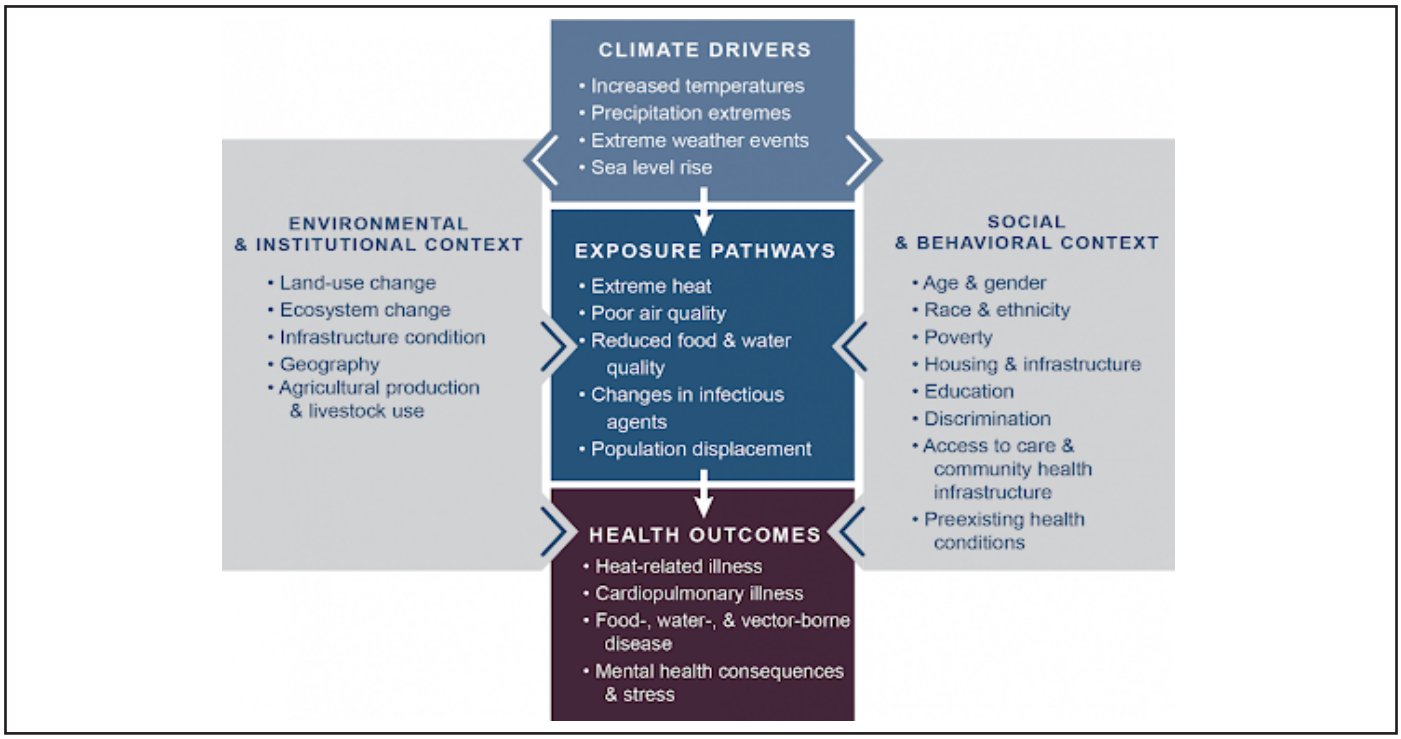

Figure 4. The Impacts of Climate Change on Human Health.41

Across Appalachia, and in particular the central and southern portions, there have been numerous factors that directly affect environmental health disparities. In particular, Krometis and colleagues[42], describe the role that coal mining and natural gas extraction have played over the last several decades across the region. These are significant economic engines in the region that will require complex systems changes to move away from these sources of energy production. Another plausible environmental health concern for air quality is the higher rates of tobacco use and smoking, which has also been associated with numerous effects on human health. The region is also experiencing many of the ongoing changes to air quality stemming from global climate change. As such, air quality and lung-associated health issues have been major issues. Additionally, water quality and safe drinking water have been notable challenges, due in large part to the higher rates of private drinking water systems, such as wells, and the impacts that mining and other activities, such as agriculture, can have in the form of runoff. There are also concerns over the impacts global climate change will have on agricultural production and food security/hunger issues across the region.

Specific to the High Country, air pollution in the form of particulate matter is relatively low when compared to North Carolina in general. This is likely due to the rural context, less traffic congestion, and lower levels of harmful substances released into the air. Of the seven counties, only two (Alleghany and Watauga) have had drinking water violations in the past year. Housing appears to be relatively stable outside of Watauga County, which faces challenges with the large university student population; in fact, there are much higher rates of severe housing problems, lower rates of home ownership, and severe cost burdens found in Watauga. Sugg and colleagues[43] further examine the climate and environmental determinants of health in their article and highlight the High Country.

Good health and well-being

As aforementioned in the introduction of this paper, the Appalachian region performs much poorer in terms of health behaviors and health outcomes when compared to the rest of the U.S. Much of this is, of course, due to underlying social and environmental inequities and limited attention and focus on the driving forces of poor health. Specific to the High Country, there are several health behaviors and outcomes that stand out and are in dire need of intervention and policy support. When compared to the state of North Carolina, each of the High Country counties have slightly higher numbers of poor physical and mental health days per month. Outside of Watauga County the region has significantly higher rates of diabetes, physical inactivity levels, and access to exercise opportunities. In their article, Towner and colleagues[44] delve into their interdisciplinary work and approaches through the HOPE Lab at Appalachian State University aimed at promoting physical activity and exercise through outdoor play and taking advantage of all of the beautiful scenery that is found in the High Country. Healthcare and access to healthcare resources are a serious challenge across the High Country, with higher rates of uninsured and access to practitioners due to a shortage, particularly when it comes to dentistry and mental health needs. As Reed-Ashcraft and colleagues[39] describe, it takes a lot of collaboration and sustained trust across the communities to meet the unique needs of the High Country citizens.

Governance/trust in institutions/assets/partnerships

Effective and sustainable partnerships and good governance are vital to addressing systemic social, economic, environmental, political, and health inequities across the world, U.S., Appalachia, and the High Country. Unfortunately, across much of the United States and world at large, there is a large public distrust of governments at all levels and institutions in general. This has amplified over the past couple of decades and leads to serious challenges in being able to solve some of the world's most complex challenges, which are all found within the SDGs. It creates challenges to being able to develop effective partnerships and to build the political will for changes that are needed. In particular, research from Pew[45] has found growing distrust in scientists, politicians, the media, and governments at all levels and that we have increasingly become more politically partisan. Therefore, one of the great challenges of the 21st century is in recapturing this sense of trust in public officials, institutions, and governments and the pursuit of the common good.

In Appalachia, the Appalachian Regional Commission[46] (ARC) serves as a regional economic

development agency for Appalachia and represents a partnership between the federal, state and local governments across the region. As a part of this, the members and partners within ARC include the governors from the 13 states, one federal co-chair appointed by the President and much grassroot participation from local governments, multi-county agencies, elected officials, the business community, local leaders, and citizens of the region. With it being a major player across the region, it serves as a central target for improving relations and building trust, as well as improving the quality of life across the region. The current strategic goals include: innovation and economic development; improvement in education and health of workers across the region; infrastructure development (internet, transportation, highways, water systems); using the assets across the region, such as nature and cultural heritage to strengthen community and economic development; and helping to build capacity and the next generation of leaders to advance these goals. ARC is very strategic in their approaches, but they serve as the primary grant-funding support system across the region and fund projects related to development, infrastructure, education, energy, health, tourism development, and transportation, among others. Therefore, ARC is critical to the future sustainable development goals of the region.

When examining things more local to the High Country, the High Country Council of Governments (HCCOG)[47] serves the seven counties and 19 municipalities. It is supported by both state and federal funding to help serve the region and the local governments. As a part of their goals, the HCCOG helps to promote economic development and workforce development needs and to develop partnerships and collaborations within the High Country and beyond to help improve the health, wellbeing and quality of life of citizens. Specific focus areas include community-based services aimed at the older adult population through the High Country Area Agency on Aging, funding for and support of community and economic development initiatives, and helping to develop the future leaders through their workforce development efforts. These initiatives help to address the SDGs and specifically targets SDG #17 along the way, which is vital to the long-term future sustainability efforts. In their article in this volume, McCullough and Bouldin[48] detail how local rural communities, through leveraging collaborative opportunities between the HCCOG and other community assets, can promote more sustainable environments for the aging population. Figure 5 presents a conceptual model of the surrounding factors affecting the health and wellbeing of High Country citizens for the short and long-term futures as well as assets and partnerships and governing characteristics that leaders should capitalize upon in response.

Setting the stage for the following articles in this volume of Sustainable Health

As described in the preceding sections of this article, sustainability, health, and the SDGs are all complex matters that involve complex solutions. These numerous challenges found in the SDGs didn't happen overnight and they're unfortunately not going to be solved overnight. However, in the midst of COVID-19, it has become increasingly evident of our urgent need, both globally and domestically here in the U.S., to address these issues. COVID-19 has taught us how intricately connected we all are as a human race and how dependent upon each other we are for our own individual health and well-being. It takes all of us working together and collective action to have a collective impact. As Diez Roux[22] recently expressed, "the pandemic may be producing unanticipated opportunities for population health, by illuminating (in ways that were often unintended) how we can use our power as a society to change the way we live and to create systems and environments that promote health and health equity…It's time for us to be open to re-envisioning what a healthier society would like."

While the challenges before us are daunting, the High Country is well-equipped and has the tools necessary to be a leader in creating a sustainable health system for all. It doesn't mean we can do "business as usual", but we can build upon the assets and opportunities that are found right in our midst. The roots for change, however, are all around us. The High Country is home to some of the best teachers, educators and school systems, has high levels of social cohesion, social capital and trust, has beautiful nature and tourism opportunities, has faith-based institutions engaged in and committed to service in their communities, and has numerous not-for-profit agencies addressing the many health and social challenges facing residents. To add to it, Appalachian State University employs faculty and staff committed to community-engaged research and service and

possesses the skillsets and expertise to take on and lead in many initiatives aimed at addressing SDG focus areas. In addition, the faculty are training their students to do like-wise and to prepare them to employ both empathy and critical thinking aimed at improving the quality of life for future generations to come. Appalachian State University further has sustainability as a primary pillar, and it is interwoven into much of the university's strategic plan. The university has two large research institutes in theResearch Institute for Environment, Energy, and Economics (RIEEE) and the Blue Cross NC Institute for Health and Human Services that can help to spearhead university-community collaborative opportunities. The High Country also has its local governmental institutions connected and supported through the High Country Council of Governments, which offers further collaborative opportunities for addressing the SDGs in the local communities. There is no doubting that the High Country has everything that it needs to transform communities and improve the lives of the citizens of this region of North Carolina.

However, at the end of the day, all of our work should and will require university researchers and officials, local leaders (formal and informal), and policymakers all collaborating with the most important piece of the puzzle: the people that we serve. To be sustainable in our approach, it requires us to "go to where the people are" and to "meet people where they are" and to be participatory in our decision-making and in developing solutions. As many in community and sustainable development and public all say: We work with people, not on people. The people all around us, who all have different lived experiences, hold the answers to the challenges – if we are willing to listen, to include, to be transparent, and to be held accountable for responding to the needs of the citizens around us. It is our duty and responsibility do so!

The following articles in this volume all present local and regional work in the areas of sustainability and health from Appalachian State University researchers and community partners. These are all just a glimpse of the work currently being done and the potential for all that can be done moving forward. The volume features Appalachian State researchers from the disciplines of Geography and Planning, Nutrition, Public Health, Communication Sciences and Disorders, Health and Exercise Science, Sustainable Development, Recreation Management, Social Work, Healthcare Management, Sociology, and Global Studies, among others. Contributions from community agencies includes: AppHealthCare (local health department); the North Carolina Institute for Climate Studies; Second Harvest Food Bank of Western North Carolina; Hunger and Health Coalition; Appalachian Regional Healthcare System; Watauga County Schools; Children's Council of Watauga County; Hospitality House; the Area Agency on Aging; and Daymark Recovery Services, among others.

Concluding remarks

In his recent piece COVID-19 and Multilateralism published in Consilience: The Journal of Sustainable Development, notable sustainable development scholar and leader, Jeffery Sachs[49], stressed the critical nature of the world that we live in right now during a global pandemic and the necessity for nations around the world to work collaboratively to address the numerous pressing needs. Specific to the U.S., he said, "we find ourselves in the U.S. in an epidemic, a depression, a geopolitical conflict, and a period of deep instability." We can't continue on this same trajectory.

In this article, I've sought to give an overview of sustainability, sustainable development, and all of the various factors involved in addressing population health and quality of life. The world and country we currently find ourselves in is in dire need of leadership, cooperation and collaboration aimed at alleviating human suffering all around us, globally and domestically. COVID-19 has brought to the forefront the vast inequities, but it has also given us an opportunity to re-envision the world in which we live and the systems in place. Moving forward, it is vital that we use the framework found in the Sustainable Development Goals at a global level but also domestically and in our local communities. The SDGs lay out an invaluable framework for how we as a society can continually improve the human condition – it's our job as global citizens to put it into action and leave the world in a better place for the generation after us.

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Sustainable Support for Rural Mental Health & Adverse Childhood Experiences

Kellie Reed Ashcraft, Lisa Curtin, Jenna Crawley, Annette Ward, Kayla Forliti, Sierra Apple

Increasing attention over the last decade has focused on rural mental health, including the impact of the "social determinants of health," such as lack of economic opportunity, lack of affordable housing, transportation issues, social isolation, and pervasive poverty. Further, research regarding adverse childhood experiences (ACEs) has grown exponentially as urban and rural communities work collectively to address the impact of trauma and build resiliency within their communities. In this article, the diverse populations and unique characteristics of rural and Appalachian mental health are highlighted with a focus on ACEs and other risk and protective factors. The convergence of these factors and special populations are further demonstrated in one rural northwestern North Carolina county in Appalachia. In addition, targeted evidence-based and promising rural mental health practices are described. The authors conclude with recommendations and a framework for sustainable rural mental health support moving forward.

Introduction

Rural mental health has long been a focus of interest,[1,2] and mental health in Appalachia has received special attention due to its shared characteristics with other rural communities[3, 4, 5] as well as distinct cultural characteristics.[6, 7, 8] In the following article, the authors provide a brief review of rural mental health and Appalachian mental health with a focus on adverse childhood experiences (ACEs), social determinants of health (SDOH), and protective factors as well as targeted evidence-based and promising practices in an Appalachian county in the mountains of western North Carolina. Finally, implications and future directions for sustainable rural mental health, including opportunities and challenges, are discussed for western North Carolina, Appalachia, and beyond.

Rural Mental Health

Many definitions exist for the term "rural." The US Census Bureau[9] defines urban as geographic areas of 50,000 or more people and urban clusters of at least 2,500 to 50,000 persons, with the term "rural" applied to all other areas. Approximately 19% of the US population lives in rural areas.[10] According to 2010 Census data, approximately 78 percent of the US rural population is white/non-Hispanic, 9 percent Hispanic, and 8% African American, with other races/ethnicity comprising the remainder of the population.[11] Further, while diversity growth in rural areas has been slower than in urban areas, the rural US is becoming more racially and ethnically diverse, accounting for 83% of the population growth between 2000 and 2010.[12]

In addition to growing racial and ethnic diversity, rural areas include a number of marginalized populations. Although rural populations experience poverty to a greater degree than urban and suburban populations, racial and ethnic minority populations in rural areas experience inequities in the social determinants of health and poverty at a higher level than rural white populations.[13, 14] Similarly, persons who identify as gay, lesbian, bisexual, and transgender and who live in rural areas, use health services at lower rates and experience greater levels of stigma compared to cisgender men.[15] Further, many persons who are homeless reside in rural areas. The National Alliance to End Homelessness[15] reports that 7% of persons who are homeless live in rural areas. The rural homeless population is considered an undercount, with more people living outdoors, in vehicles, with friends and relatives, and living in substandard housing.[15,16] In addition to the lack of housing or substandard housing, homeless rural persons also fare poorly compared to urban persons on other social determinants of health including transportation and persistent poverty.[16]

Rural and urban populations are similar in terms of prevalence rates for diagnosable psychiatric disorders and exposure to trauma.[17] However, rural and urban areas differ in some ways relative to mental health. In their study of mental, behavioral and developmental disorders (MBDD) among children ages two to eight years, Robinson and colleagues[18] found a higher prevalence of MBDD among children in rural areas (18.6%) when compared to children in urban areas (15.2%). Similarly, Ivey-Stephenson's team[19] reported that rural/nonmetropolitan areas had higher suicide rates than metropolitan or urban areas in their examination of US suicide trends from 2001-2015, and Fontanella et al[20] found similar trends among rural youth. The majority of differences between urban and rural areas in mental health likely relate to other contextual factors. Importantly, major differences exist between rural and urban areas in terms of availability, accessibility, and acceptability of mental health services.[4, 21]

Rural communities often lack available mental health services and mental health specialists.[22] Shortages of mental health providers are a major issue, with 60% of rural Americans experiencing these shortages.[23] While Mohatt[23] notes problems in tracking mental health providers, he reports that approximately 90% of psychologists and psychiatrists and 80% of Master of Social Work (MSW) professionals work in metropolitan areas. Mohatt[23] further notes that 65% of rural Americans receive mental health care from their primary health care provider and mental health crises in rural areas are primarily responded to by law enforcement personnel.

Even when mental health services are available, accessibility may pose a problem in rural areas. Accessibility includes lack of transportation, distance from available services, isolation, and telecommunication problems encountered in rural areas. In their 14-state study of rural-urban disparities in health and mental health home and community-based services (HCBS), Siconolfi and colleaguesl[24] found that accessibility and other issues resulted in fewer HCBS in rural areas among key stakeholder participants. As a result, rural individuals often relied on informal caregiving, likely due to these disparities or to cultural preferences. The researchers note that addressing inequities is paramount to limit long-term negative consequences for rural populations. Similarly, transportation was identified as an issue by caregiver and staff respondents in a study of barriers to and supports for family participation in a rural system of care for families of children with serious emotional problems.[25]

Another, often difficult to detect, barrier to rural mental health treatment is the perceived acceptability of seeking external support. In their review and meta-synthesis of targeted qualitative research, Cheesmond et al[3] identified four related barriers among rural residents in seeking mental health support. The first barrier identified across studies was "stoicism" or the value of rural residents to cope silently with mental distress. A related barrier was stigma or the perceived stigma that rural residents would be judged negatively if they seek external support for mental health issues. A third barrier was distrust of mental health providers from outside of the community and the mental health system as a whole. A final barrier identified was the meaning and language assigned to mental health issues and deemed acceptable to rural residents across studies.[3] These findings were supported by Snell-Rood's team[7] in their 2017 qualitative study of socio-cultural factors impacting treatment-seeking behaviors among low income, depressed women in Appalachia. Snell-Rood et al[7] found that participating women who experienced depression reported ambivalence in seeking help even when they had mental health concerns or depression, believing that they should be self-reliant. The women reported self-stigma about seeking mental health treatment as well as fear of stigma from others in the community.[7]

Appalachian Mental Health: Risk and Protective Factors

Mental health concerns and barriers to mental health treatment in rural parts of Appalachia look similar to other rural areas. The Appalachian Regional Commission[26] defines the Appalachian Region as 205,000 square miles of the Appalachian mountain range, including portions of North Carolina, Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, Ohio, Pennsylvania, South Carolina, Tennessee and Virginia, and all of West Virginia (para. 1).

Russ[27] suggested that "People of Appalachian culture are an invisible minority" (p. 1) and are not immune to mental health-related issues. Barriers to mental health treatment, including accessibility, availability,[28] and the cultural acceptability of seeking external mental health treatment[8] are similar in

Appalachia to other rural areas. Marshall and colleagues[29] reported that of the 420 counties which comprise the Appalachian region, 50 percent rank in the worst quintile in the nation for the number of mentally unhealthy days, with only two counties ranking in the best quintile. They also reported that the prevalence of depression among Medicare beneficiaries is 16.7 percent in comparison to a rate of 15.7 percent for all Medicare beneficiaries in the U.S, and the suicide rate in the Appalachian region is 17 percent higher than the national rate.[29] Intimate partner violence resulting in hospitalizations,[6] and prevalence of drug abuse[20] and drug overdose[31] are also concerns in Appalachia. Stressors are associated with the onset and maintenance of mental health problems, many of which can be mitigated by protective factors. Although not exhaustive, specific risk and protective factors are discussed below.

Adverse childhood experiences (ACEs)

ACEs' research is based on the 1988 study conducted by Dr. Vincent Felitti and his team[32] with a sample of 17,337 respondents.[33] Respondents provided data about abuse, neglect, and household dysfunction that occurred before the age of 18, and the researchers examined these scores in relation to various measures of health, disease, and risk behaviors.[32] The researchers found that ACEs were common, with 63% reporting at least one ACE. Further, the risk for negative health outcomes and risk behaviors increased exponentially for adults who reported more ACEs.[32] Of note, experiencing a greater number of ACEs increases the mental health risk for adults of depression, anxiety, suicide, post-traumatic stress disorder, and alcohol and drug abuse, along with other negative health outcomes.[33]

Research is more limited regarding ACEs and mental health among rural and Appalachian populations. In their research based on data from the 2011 and 2012 Behavioral Risk Factor Surveillance System (BRFSS) for nine states (N=79,810), Chanlongbutra, Singh, and Mueller[34] found that while rural residents experienced fewer ACEs than urban counterparts, over half of the rural respondents reported experiencing at least one ACE. Further, the odds of having poor mental health or asthma were higher for rural residents who experienced 3 or more ACEs. Similar findings were reported by Iniguez & Standowski[35] in their community-based ACEs study of 800 rural residents in northern and central Wisconsin. Using a follow-up telephone questionnaire to data collected from the BRFSS and from electronic medical records from a regional medical clinic, the researchers found that 62% of the respondents reported at least one ACE, a rate nearly identical to the original finding of Felitti et al.[32] Further, frequent mental distress and heavy drinking as well as other negative self-reported risk behaviors and negative health outcomes were associated with higher ACEs scores. These findings were consistent with data reviewed from the electronic medical records in which a diagnosis of depression or anxiety positively correlated with a higher number of ACEs.35 Similarly, Hege et al[36] found no statistically significant differences in the prevalence of ACEs between residents from 29 Appalachian counties in North Carolina compared to residents from other counties in North Carolina based on 2012 and 2014 BRFSS data. However, the researchers reported that there were statistically significant increases in mental distress, heavy alcohol consumption, smoking, and food insecurity for Appalachian respondents who reported four or more ACEs in comparison to non-Appalachian residents.[36] The researchers noted that research on ACEs and the social determinants of health may be particularly important for Appalachian and rural populations.

Indeed, in 2017, an Appalachia ACEs expert working group explored ways to address the opioid epidemic in Appalachia in relation to ACEs.[37] Professional stakeholders from seven states in central and southern Appalachia reviewed and discussed measurement of ACEs, vulnerability and protective factors, and local needs and resources. Specifically, the work group identified several adverse experiences not captured by current ACEs scales, which suggests the prevalence of ACEs found in previous research in Appalachia, and perhaps other areas, is an underestimate. The work group identified parental/caregiver unemployment and repeated attachment ruptures (e.g., multiple divorces or cohabitating relationships) as most prevalent, and death of an attachment figure, witnessing an overdose, and repeated ruptures in attachment as most impactful on children, which are typically not assessed.[37]

Social Determinants of Health: Risk and Protective Factors in Appalachia

Social determinants of health (SDOH) are the

conditions in which people live, and include factors such as housing, education, employment, transportation, access to food, access to health care, access to technology, social support, and culture, among other factors.[38] According to Marshall et al,[29] distressed Appalachian counties are those counties in the US that are the most economically disadvantaged. They report that 84 Appalachian counties qualify as distressed counties based on high poverty rates, unemployment, and low per capita income.[29] The researchers also report that adults between the ages of 25 to 44 in the Appalachian region are less likely (57.1%) than their counterparts in the rest of the US (63.3%) to have attained some level of post-secondary education. Further, in an investigation of the "diseases of despair," which refers to death due to alcohol and drug overdose, suicide, and liver disease, Meit et al[39] found that the Appalachian region had a 37 percent higher rate of mortality due to these diseases in comparison to the rest of the U.S between 2014-2015.

Social support and culture are additional social determinants of health. Although research is more limited, these often appear as protective factors or strengths in Appalachia. In Helton and Keller's[40] qualitative study of Appalachian women reflecting on their childhood, support including positive family support and familial communication, a caring neighborhood, and close relationships with other community members emerged as a common theme.[40] Similarly, a qualitative study conducted by Dakin, Williams, and MacNamara[41] of an often marginalized population (i.e., lesbian, gay, bisexual, and transgender older adults) in Appalachia, identified a "family of choice" including neighbors and pets as strong sources of support, along with religious or spiritual practices. These findings are consistent with the anthropological observation of social capital being a strength in Appalachia.[42] Appalachian social capital includes strong familial, community and informal social networks that thrive on interdependency, reciprocity, and trust.

A cultural determinant of health is religion, which is often a source of support in Appalachia, with a long historical, community, and individual tradition of finding comfort, community and connection in church, particularly among adults.[44] Pastors, preachers, and church leaders engage with their congregation and individuals often look to religious leaders to support them through both challenges and celebrations.[44] Connection to a faith community is associated with improved mental well-being.[41]

Strong connections to the land, to nature, and to a cultural heritage represent additional protective factors.[42] The mountains, streams and views provide both natural beauty and sustainability for families.[44, 45] Local people recall a shared "commons" area for livestock and farming[46] and practical use of the land for food and medicine.[47, 48] Health and mental health benefits related to time in less developed natural areas also are documented.[49]

The close collaborations among mental health providers are another strength of rural communities. In Pullman et. al's[25] study of supports and barriers for families participating in systems of care for children with serious emotional issues, staff and caregivers identified the "close-knit" service providers as an existing support (p. 215). Further, scarcity of formal mental health providers may facilitate collaborative relationships in rural areas and reinforce the importance and strength of social capital in Appalachia.[42]

A Case Example: Western North Carolina and Appalachia

Local population characteristics, history, culture, and resources are important to consider in the context of developing sustainable rural mental health infrastructure. To illustrate, a case example of a northwestern North Carolina Appalachia county (Watauga) is presented. The county has an estimated population of 56,177 in 2019.50 Although the county is predominantly Caucasian (91.6%), the county includes racial and ethnic minorities: 3.7% Hispanic or Latino; 1.9% African American, 1.6% bi- or multi-racial; and 1.2% Asian,[50] with persons who identify as Hispanic or Latino as the fastest growing ethnic minority group.[51] Other marginalized populations include persons who identify as gay, lesbian, bisexual, or transgender,[41, 52] and persons who are homeless.[53]

Social determinants of health, including risk and protective factors, also are illustrated for the county. The 2018 per capita income was $24,906, with a 21.2% poverty rate.[48] According to the Appalachian District Health Department,[54] the unemployment rate for bi- or multi-racial residents is 33.6 percent; for black or African American residents, 12.8 percent; and for residents of Hispanic or Latino origin (11.5%), compared to 8.2 percent for white or Caucasian

residents (American Community Survey Estimates, 2012-2016). The Appalachian District Health Department 2017 Map the Meal Gap 54 reports that 3 out of 10 households in the county are food insecure, and do not qualify for the Supplemental Nutrition Assistance Program (SNAP) or other similar benefits. Further, although 17 percent of North Carolina households report issues with housing, in this target county, approximately 28 percent of respondents report these issues.[54] Similar to other Appalachian and rural counties, the lack of transportation is considered a barrier to accessing services, particularly for older adults.[54] Finally, the most reported health concern from the community health survey is substance misuse, and community coalitions ranked the three health priorities for the county as substance use and prevention; mental/behavioral health; and physical activity and nutrition.[54]

One protective factor or strength is strong informal social support among community members. It is common for local businesses, schools, and organizations to hold spaghetti dinner fundraisers to support cancer or medical treatments for specific individuals, to conduct food or clothing drives for specific families, to establish Go Fund pages for community members in need, or to display money jars next to cash registers to raise funds to support a community member.

Similarly, a strong sense of family, a cultural belief of "taking care of your own," and deeply-held religious beliefs are important to many local families.[27, 55] Being "local" has significance community families, specifically having multiple generations born and raised in the county or a surrounding county. It "does not count' just to be born in the area. Being from a family living in the region for multiple generations automatically provides a level of credibility, as long as the family has a positive reputation.[27, 55] In addition, if an "outsider" or any formal service provider, belittles or disrespects a local client, even inadvertently, by discounting cultural beliefs, the relationship is damaged and may result in the client ending services, many times without explanation.[27, 55]

A cultural belief of "taking care of your own" also means that locals may not seek assistance outside of the family, but may be willing to accept assistance in desperate times.[55] This assistance, in the form of church and community connections[55] may provide support through phone calls, visits, prayers, food and supplies, and labor, particularly in times of sudden tragedy or physical health challenges or sudden tragedy.

Culture can be both a strength and barrier as a social determinant of health. For example, receptiveness to mental health services depends on many factors including, but not limited to, the community member's connection to their Appalachian heritage.[27, 55] Further, having a strong spiritual or religious foundation often serves as a guide for addressing challenges related to mental health.[40, 55] However, religion also has been detrimental for some. For example, some community members speak of feeling ostracized by their church for having experienced traumas over which they had no control, for having experienced addiction or been faced with prostitution, or for being a member of the LGBTQ community.[56] Mental health providers must recognize the complexity of culture in the different lives of community members they serve.

Another community strength is the long-standing collaboration among service providers which parallels Appalachian findings.[25] Service providers know one another personally, and have both formal and informal referral mechanisms for clients. Therapists in private practice commonly refer clients to other colleagues in the community due to full caseloads or specific areas of expertise. Similarly, community-wide committees often are initiated informally such as a substance collaborative initiated by a local therapist that includes private practitioners, staff from private non-profit agencies, governmental entities, and the local university. In addition, staff from different agencies often collaborate to seek funding for services and programs (e.g., cross-system mental health effort to serve families of children with severe emotional and behavioral issues; cross-system methamphetamine treatment and evaluation program).

Finally, the county includes some unique strengths and resources. A large regional public university is located in the county, providing employment, higher educational opportunities, and a number of tangible and intangible resources. In addition, the regional healthcare system and hospital are located in the county, also providing employment and healthcare benefits. These major resources are strengths that many other rural and Appalachian counties do not have at their disposal.

A Case Example: Targeted Evidence-based & Promising Mental Health Practices

With this backdrop, the target community highlights a number of evidence-based and promising mental health practices. that demonstrate the community's ability to address the mental health needs of its current and changing population. They also target social determinants of health while addressing community barriers and utilizing the community's protective factors and strengths. Importantly, a number of practices address the emerging area of ACEs through multiple linked efforts. In the following discussion, a number of these practices are described.

Trauma-Informed Community Initiative

A multi-year trauma-informed community effort has been underway for three years in the county. The effort includes non-profit agencies, the school system, the department of social services, public mental health, private mental health providers, the health department, the hospital, paramedics, law enforcement, the faith community, the university, and interested community members who engage at the individual, family, organizational, and community levels to recognize, prevent, and treat trauma, and build resiliency. The initiative has multiple foci: 1) providing targeted trainings for community members, groups, and organizations; 2) developing and advocating for trauma-informed policies at the agency, local, and state levels; 3) seeking funding to support specific and community-based interventions; 4) collecting and using agency, county, and community data to identify gaps and needs; and 5) facilitating a yearly, community-wide conference.[57, 58] Based on ACEs research, community-based, trauma-informed efforts are growing with 350 geographically based communities currently identified by ACEsConnection.com.[59] However, research about these efforts is limited and primarily descriptive.[60]

This community initiative illustrates a number of strengths. First, the initiative benefits from the close-knit, long-term relationships among service providers in the community. All of those involved are volunteers, and the initiative does not currently have paid staff. In addition, the initiative supports and facilitates trauma-based prevention and intervention targeted to individuals, children, and families collectively and through partnership organizations to mitigate ACEs. At the community level, the initiative has goals to address income disparities, and lack of affordable housing and substandard housing in the community, all of which are social determinants of health. Although work on these goals is just beginning, community participants already have demonstrated commitment and dedication to the initiative. Finally, a key goal for the next year is to focus on racial and ethnic trauma experienced by communities of color and the Latinx community within the county.

Triple P Parenting Program

The Positive Parenting Program (Triple P) is an example of an evidence-based preventive mental health and support program provided through a partnership between a local non-profit agency and the health department. The Positive Parenting Program has a strong evidence-base and may be used in prevention or intervention with parents,[61, 62] and was identified by the Appalachian ACES work group.[37] In the target community, the local health department provides trained staff while the non-profit agency identifies high-risk families and is a resource for other rural parents who could benefit from the program. Social support and education are provided to participating parents, which relieves isolation, reduces stress, and contributes to positive mental health. In addition, with the COVID-19 pandemic, the program is available online to parents through the non-profit agency, which makes it further accessible to rural parents.

This program is noteworthy for a number of reasons. First, the availability of the program online increases accessibility for all families regardless of transportation, a social determinant of health. Participating parents meet other parents thus increasing their social support and furthering community connections, another social determinant of health. Further, both the non-profit agency and the local department of social services refer vulnerable families to the program. Participating parents develop tangible skills and resiliency that support healthy child development and can prevent adverse childhood experiences.

Family Connects Program

A new prevention-focused, evidence-based program is a home-visiting nurse program. The program, "Family Connects," is available to all families within

the county with a newborn. The effort is the result of a partnership among the health department, the same non-profit agency, the local hospital, and a local pediatrics practice. The program provides a home visit from a postnatal nurse who conducts a standardized assessment, provides health services, answers questions, provides referral to other services, and provides a follow-up as needed.[63] The program launched in March 2020 amidst the pandemic, slowing implementation. Even so, staff have been able to offer the services through telehealth. In clinical trials of the program, families randomly assigned to the program reported more positive parenting behaviors, fewer serious health issues and injuries with their infants, and stronger connections to community resources in comparison to control families.[63]

Implementation of the program illustrates other strengths. First, through the current use of telehealth for service delivery and by providing services through home visits, the program successfully addresses accessibility issues and problems with transportation. In addition, social isolation of new parents is reduced, while connections to community resources and social support are enhanced. Further, stress that new parents encounter is lessened by the knowledge and skills provided by the nurse, which in turn reduces stress which underlies adverse childhood experiences and trauma.

Services for At-Risk Community Members

At-risk populations in the community include persons who are uninsured, homeless, or who may be experiencing intimate partner violence. To respond to their unique and multiple needs, a promising practice launched in 2010 through a collaborative grant between the local homeless shelter and a non-profit community health clinic provide health and mental health care to persons who are homeless as well as to uninsured and Latinx community members. The grant, which ran for four years, resulted in the hiring of a full-time mental health and substance abuse therapist who spent 20 hours a week at each agency providing individual counseling, workshops, and case management services to clients at both agencies. Due to its success, the health clinic and the homeless shelter established plans for continuing the program following the completion of the grant. The health clinic has since expanded the therapy services to include a second mental health therapist position, increasing therapist availability hours from 20 to 30 a week. Therapy at both agencies is free and voluntary. The therapist(s) have a good working knowledge of ACEs and trauma informed care, have been trained in trauma effective treatments, and seek consultation and additional training in order to meet the needs of the clients.

Additionally, the homeless shelter partnered with the local domestic violence program to provide workshops based on increasing resilience to any interested women. The workshops address a different topic each week, occur weekly for six weeks twice a year, are voluntary, free, and offer incentives. At this time, the program was suspended due to COVID-19, but plans exist to begin again when it is possible. It is important to note that service gaps still exist. While there is a current partnership between a local Latino health program and the health clinic to provide interpretive services, there continues to be a gap in providing mental health care to community members who do not speak fluent English. Spanish-speaking mental health therapists are identified as a current need.

With the pandemic, mental health and substance abuse counseling services transitioned from 100% in person to 100% telehealth and telephone sessions. The shelter set up a computer and space for residents to meet with the mental health provider in a private space, while former residents who no longer reside at the shelter can use their own technology for sessions, the shelter's technology for sessions, or can participate in phone sessions. Similarly, the clinic patients moved to a telehealth platform in their homes, engaged in telephone sessions, or were offered the chance to utilize the clinic's technology for sessions.

School-Based Mental Health Initiatives

Schools are a common focal point in rural communities. Three promising practices have been developed in the local school system, including a school-wide trauma-informed effort, a collaborative school-based therapy program, and a specialized treatment center at the high school.

A Trauma-Informed School System

The target county has ongoing efforts to become a trauma-informed school system.[57] Based on ACEs-

related research, these efforts are sometimes referred to as "Compassionate Schools".[64] A literature review by Fondren and her colleagues[65] noted that these efforts are being implemented across the US, with positive results identified for specific interventions. However, these and other researchers note that more rigorous research is needed, particularly for multi-tiered school efforts.[65,66] In the target county's school system, the model features ongoing trauma-based training for all school personnel; school-specific compassionate care teams; a "silent mentor" program pairing all school personnel (i.e., teachers, bus drivers, custodians) with at-risk students; installation of "calm corners" into each classroom; resiliency-skills training for students in the classroom, and development of a county-wide trauma-informed strategic plan.[55]

This effort demonstrates a number of positive factors. First, by locating the effort throughout the entire school system, all students benefit from resiliency skill development, multiple supportive and caring trauma-trained staff and teachers, and a consistent and positive school culture. Students from under-represented racial and ethnic groups, students with different identities, students who experience learning difficulties, and other vulnerable students benefit from the same services, resources and supports of the effort. The program is one of the most well-known efforts to address ACEs preventively.[64]

School-Based Therapy

Another promising practice is a collaborative school-based therapy program between the regional mental health provider and the school system. The program was developed in 2005 to serve children with mental health concerns who were underserved and to eliminate barriers including transportation issues, caretaker and/or child missing time from work and school, and stigma in seeking treatment. The program began with one mental health provider available a few hours per week in some of the schools, and expanded to every school in the county, including the high school. Schools provide the therapy space, and assist with referrals and coordination with teachers regarding appointments. Therapists are employed by the regional mental health provider, and meet with students and their families in the school and make home visits as needed, taking into consideration the students', families' and teachers' wishes and recommendations regarding interventions. Further, a specialized contract for mental health care was developed by the school system and regional mental health provider to serve vulnerable students, including uninsured and undocumented Latinx students.

High School-Based Mental Health Treatment

A final promising school-based practice is the result of a mental health partnership between the school system and the local regional university.[65] The practice already has a strong evidence base with demonstrated positive findings to date.[67, 68, 69] The partnership began in 2006 at the only high school in the county, and has since expanded into 2 adjacent rural school districts. The university-school partnerships are called Assessment, Support, and Counseling (ASC) Centers. The signature services are individual cognitive-behavioral therapy (CBT) and suicide prevention, and school-wide and community education and referral also are provided. The suicide prevention components include crisis assessment, Counseling on Access to Lethal Means (CALM), and use of the Collaborative Assessment and Management of Suicidality (CAMS) program. In addition to these components, school-wide and community education is offered, along with referrals to outside agencies and providers. Thus, the ASC Center is aligned with the Multi-Tiered Systems of Support (MTSS) Model.[70] The program not only addresses mental health concerns, but supports students around gender identity, sexual orientation, past and current trauma, and ACEs.[57, 71] Based on the results of several published studies, ASC Center services have been shown to reduce psychological distress,[67, 71] reduce major depressive symptoms,[72] are correlated with improved academic outcomes,[78] help reduce suicidal ideation and prevent attempts,[73, 74,75] and reduce access to lethal means.[75] Not only does the program address mental health concerns, therapists also assess and may address past and present trauma and ACEs among youth. Students who identify as different gender and sexual identities have a confidential and safe space to explore and discuss their identities. Because the services are located at the high school, stigma is reduced, and barriers such as transportation, insurance, and costs are eliminated.

Church-Based Therapy

Another common gathering place and source of support are churches. A promising practice addressing mental health in the region is a therapy effort sponsored by a church that provides spiritual and emotional support, and professional mental health and substance abuse services to community members. In fact, the church considers this effort a ministry, and integral to its mission. Recent research demonstrates support for faith-based therapy to address mental health and substance abuse issues,[76, 77] and the importance many Appalachians place on the connection of health and well-being to faith further strengthens this type of effort.[55]

The ministry, while initially intended for members of the church's congregation, was opened to other congregations in the region due to its success. Since this is a ministry, accessibility and affordability are paramount. This includes reduced costs, support from a home church or a donation, but everyone is provided care regardless of ability to pay. A total of seven part-time counselors work with the ministry. When the counselors are at full capacity, they refer participants to other providers in the community. The clinicians work as independent contractors, and possess clinical licenses or associate licenses while working to full licensure.

The counselors identify with the Christian faith and work with participants from a Biblical-based perspective while utilizing appropriate knowledge and skills from secular education and experience that is consistent with that Biblical perspective. As a result, participants experience counseling from a culturally sensitive and strengths-based perspective. Even participants not affiliated with a church but who have connections to this religious belief system experience the same level of support and respect for their values and beliefs.[26]

This Biblical worldview is important to consider in this region since many decisions are based on this construct[54] for residents holding this worldview. Although specific expressions of Christian faith in the region vary, the influence of this belief system is prevalent, and the levels of acceptance and adherence to these beliefs is important to assess.[27] In addition, the sponsoring church houses a strong Latinx ministry program. Because of this connection, members of the Latinx community may be referred to counseling services, and counselors can access assistance for translation when needed.

Like many of the county's mental health efforts, the program continues to provide services despite the pandemic. Many participants are using phone calls and telehealth platforms to continue counseling. Some participants have been unable to continue due to other pressing issues, such as caring for and educating their children or the inability to find a time and location for privacy. As restrictions ease, counselors are beginning to see some clients in person as well as accommodate clients with telehealth appointments.

This program demonstrates multiple strengths. First, the program embraces the cultural and religious values of many community members. Further, since counseling is provided from a Biblical perspective, stigma in receiving mental health services is reduced. Second, the services are offered by culturally-sensitive and well-qualified counselors, and services are delivered from the auspices of the church, a trusted and valued community partner. In addition, through telehealth or church-based therapy, transportation issues are minimized or eliminated, and participants with limited resources are able to receive services through financial support from their home churches. Finally, co-location of the program at the church which already has an active Latinx ministry allows for access to a growing and vulnerable population.

Public Mental Health & Universal ACEs Screening

Another promising practice is universal screening for adverse childhood experiences (ACEs) among consumers served by the public mental health provider in order to provide trauma-informed services. The original ACEs questionnaire demonstrated strong test-retest reliability.[78] With the advent of COVID-19, the agency pivoted services and is now offering assessment and services by phone. Teletherapy increases access to services for consumers of all socioeconomic levels and may decrease the stigma of being observed visiting the agency. It also addresses the barrier of transportation, while reducing social isolation and increasing support. Finally, by universally screening for ACEs, the public mental health provider normalizes the prevalence of ACEs among consumers and has the capacity to address ACEs with targeted, trauma-informed treatments. Some cautions are warranted. Recent researchers note methodological

and ethical concerns with universal ACEs screening, and they recommend careful review prior to implementation of any ACEs' tools.[79, 80] Further, as noted by an Appalachian research group, the original ACEs tool may not include some adverse events experienced by children in Appalachian.[376]

Interprofessional University Clinic

One of the unique strengths is the location of a large regional public university in the community that provides many benefits. One of those benefits was the creation of an interprofessional clinic. A review of literature regarding family therapy and rural mental health[4] identifies interprofessional, integrated health care settings as a viable solution for providing mental health services in rural communities, while university-community partnerships have led to the creation of clinics that address the lack of psychiatric services in rural areas[81] and the lack of services for vulnerable populations such as migrant workers.[82] Currently, the interprofessional clinic includes speech/language services, audiological services, and social work, among others. Currently, social work students under the supervision of social work faculty provide clinic services based on community needs and input from community providers. The students work collaboratively with other university departments and community agencies to address community gaps. For example, social work students are currently engaged with the local school system, providing counseling, making home visits, and participating in community meetings. They also provide community education, and work with clients in the clinic as well as the community.

Again, COVID-19 created additional challenges, necessitating reliance on telephone contacts and sending resource information through email. In the coming year, students will be exploring more options for telehealth platforms to increase outreach to the community. Even so, the clinic demonstrates a number of strengths. First, working collaboratively with the community, the university is aware of service gaps, avoids duplicating services, and is able to provide missing community services. Second, since services are provided by students under faculty supervision, it is possible to provide services at minimal and no cost, which eliminates finances as a barrier for community members. Further, by providing services by telephone, through home visits, or at locations within the community, the clinic addresses the common barrier of transportation.

In sum, the evidence-based and promising practices described in this rural community case example highlight strengths and opportunities for other rural communities in addressing mental health. Of note, the majority of the practices were developed with community members and stakeholders, were based on identified needs, and developed and utilized partnerships. In addition, many started with grant or agency support, yet grew toward sustainability over time. Finally, ingenuity, flexibility and community partnerships allowed for a nimble response to the uncertainty introduced by the COVID-19 pandemic. In the final section, discussion of the challenges, opportunities and recommendations for sustainable rural and Appalachian mental health are provided.

Implications and Recommendations for Sustainable Rural & Appalachian Mental Health

Due to the unique characteristics of every rural community, it is not possible to generalize from the successful practices in the example. Hargrove, Curtin and Kirschner[83] further state that individuals, agencies, communities, and policymakers must recognize the heterogeneity and uniqueness of each rural community, particularly when such a community may be associated with unhelpful stereotypes. Stereotypes, stigma, risk factors, growing diversity among the population, and fewer mental health and financial resources impact nearly every rural community. However, rural communities possess numerous strengths including strong informal networks and collaborations that can be used to create opportunities.

Based on the example provided, a number of themes emerge as recommendations: 1) expanding use/access to telehealth services and advocating for expanded access and continued flexibility; 2) building on existing collaborative relationships to fund and sustain varied mental health practices; 3) creating and maintaining culturally-sensitive and respectful services with trusted providers and organizations; 4) attending to the needs of diverse and vulnerable populations; 5) conducting intervention research on mental health practices and remaining data-informed; and 6) working towards formal alignment and collaboration within and among systems.

Expanding use/access to telehealth services and advocating for expanded access and continued flexibility. As identified by the practice examples, many local mental health providers were able to quickly pivot and use telehealth and other technologies to continue to provide therapy and other services in response to the pandemic. These technologies helped participants overcome transportation barriers and social isolation. However, the pandemic also highlighted inequities in access due to lack of broadband coverage and costs. As a result, it is incumbent that local, state, and federal policy makers pass legislation with adequate funding to increase access by expanding rural broadband coverage and to reduce individuals' costs. Similarly, mental health licensing bodies and insurance providers demonstrated flexibility regarding provision of telehealth services and reimbursing for those services. Again, it is incumbent that policymakers and organizations advocate for continued flexibility from these bodies and insurers to continue to use telehealth and related technologies for provision of mental health care.

Building on existing collaborative relationships to fund and sustain varied mental health practices. The practice examples demonstrate the strong collaborative relationships between and among organizations. Research also identifies this as a strength among rural communities.[25] These collaborative relationships are beneficial in providing alternatives to meet the mental health needs of diverse community groups and are integral to funding and sustaining mental
health services. In addition, rural communities may be better positioned to seek larger funding opportunities where they may not have qualified previously due to geographic size and a smaller population.

Creating and maintaining culturally-sensitive and respectful services with trusted providers and organizations. Another theme across many of the practices is the importance of service providers and organizations providing culturally-sensitive and respectful services. This is particularly relevant when community members have experienced stigma for their cultural and religious beliefs or racial or ethnic group membership. Cultural sensitivity includes use of culturally appropriate assessment tools and treatment that integrates cultural beliefs and practices. These practices demonstrate cultural humility by integrating cultural values and beliefs. In addition, cultural sensitivity can be facilitated by those hired by organizations and by the organizations entrusted with providing these services. Hiring clinicians with clinical expertise and knowledge but who also have shared lived experiences with their clients can enhance trust and facilitate treatment. Similarly, providing services from organizations that already are trusted and respected within the community (i.e., faith-based organizations, schools) is particularly helpful for sustainability and effectiveness.

Attending to the needs of diverse and vulnerable populations. As illustrated in the community example, rural communities are becoming more racially and ethnically diverse,[11] and include vulnerable populations who may get "lost" when planning for, and delivering mental health services. As a result, it is imperative that agencies engage these populations in service delivery and implementation. As evident in the example, this includes providing services directly to vulnerable populations (i.e., persons who are homeless, members of the Latinx community, etc.), locating services strategically, and providing services in the language of populations (i.e., Spanish-speaking populations). For rural communities, this can be difficult due to limited resources. However, when seeking funding through collaborative grants, communities may include targeted components that address the needs of their special populations.

Conducting intervention research on mental health practices and remaining data-informed. Some of the community case examples (i.e., Triple P Parenting Program, Family Connects Program) have a strong research base, while another example (i.e., the Assessment, Screening, and Counseling Center) is engaged in ongoing intervention research. While delivering mental health services is the primary goal, conducting ongoing research is integral. Intervention research can inform clinicians, agencies, and the community about outcome achievement, changes needed, and gaps in services as well as the use of using existing and available data (i.e., the trauma-informed community initiative). With the community highlighted, the location of a regional public university in the community is a major benefit. Although many rural communities do not have such a resource, research can be included in collaborative grant and funding requests and agencies and

communities can seek collaborations with individual researchers, community colleges, and various think tanks and non-profits to conduct research, collect and present existing data, and provide consultation.

Working towards formal alignment and collaboration within and among systems. Seeking formal, ongoing collaboration in the community is a final theme and recommendation. In the case example, community agencies often have collaborated, including one-time funding opportunities or time or grant-limited multi-disciplinary community efforts. Formalizing these collaborations and having periodic ongoing communications between and among community agencies is another recommendation. Much like the trauma-informed community initiative example, formalizing collaborations and providing a venue for formal and periodic communication provide opportunities to identify community-level outcomes, engage in system alignment, and avoid duplication of services. In fact, the existing trauma-informed community collaborative provided the foundation to convene key faith-based organizations, the school system, local businesses, agencies, and interested individuals to meet to collectively address food insecurity experienced by many individuals and families due to the pandemic in the spring, 2020. Thus, formal cross-system collaboration and communication allows communities to address emerging needs as well.

While rural communities experience challenges, they also possess strengths to meet the diverse mental health needs of their community. The recommendations presented are not a panacea for addressing mental health in rural communities, but they may provide guidance for service providers, administrators, policy-makers, and communities. Most importantly, sustainable rural mental health services are well within the realm of possibility for western North Carolina, Appalachia, and other rural communities.

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Hunger, Poverty and Health: Community-Academic Partnerships that Improve Food and Nutrition Security in Rural Appalachia

Melissa Gutschall, Amanda Hege, Alisha Farris, Elizabeth Young, Maegan Furman, and Robin Fox

Background/Purpose Malnutrition, present as both overnutrition and undernutrition, is the largest single contributor to disease in the world. This article will describe the relationship between hunger, poverty and health, from the global to local level, with a focus on the relationship between hunger and obesity in the United States. The socio-ecological model will be used to present a community-academic partnership for addressing food insecurity and improving health in rural Appalachia.

Partners Hunger and Health Coalition, Appalachian State University Department of Nutrition and Healthcare Management, and the Appalachian Regional Healthcare System collaborated to address the hunger-obesity paradox in Appalachia.

Target population Individuals in Watauga County, which has the third highest poverty rate in North Carolina. The population of 51, 079 residents is 94.5% White, 1.7% African American, and 3.4% Hispanic or Latino and 59% are recipients of food assistance.

Methods Describe community, organizational and policy-level initiatives implemented by the partnership, including community forums, nutrition education, sustainable food systems, healthcare-based food security screenings and resource referrals. Discuss facilitators and barriers over time, and the interface among academic and local partner responsibilities, resources, and goals.

Outcomes Action steps focus on growing the community-clinical partnership, influencing policy, systems and environmental change, and ultimately fostering a clinical shift toward sustainable health. Improved food security and health status of the target population, nutrition professionals prepared for non-profit work, and a partnership model that can be replicated or scaled nationwide.

Conclusions Social, economic, and environmental factors have a profound impact on nutrition-related health outcomes and call for integrated, system-based approaches. Community-academic partnerships offer a unique opportunity to address food insecurity as a social determinant of health.

Introduction

Hunger is on the rise, affecting the health and development of millions of individuals across the globe. Malnutrition, the lack of proper nutrients to meet daily needs, is the single largest contributor to disease in the world. Present as both overnutrition and undernutrition, "malnutrition in all forms" is a global problem with consequences including chronic disease, early mortality, reduced child development, and lack of economic productivity. [1]

Undernutrition results from insufficient intake of energy and nutrients to meet an individual's needs. Beyond adequate calorie intake, micronutrient availability is a critical component of proper nutrition. Inadequate micronutrient intake of mothers and infants has long-term impacts on the growth and development of the child, which most specifically

occurs during the child's first 1,000 days from conception to their second birthday. [2] Overnutrition, due to an overconsumption of certain nutrients such as proteins, carbohydrates, and fat, contributes to the development of chronic diseases including obesity, heart disease, diabetes, stroke, and certain types of cancer. It is possible to be overweight or obese from excessive calorie consumption but still not get enough vitamins and minerals to promote health.[3]

Overnutrition disproportionately impacts low-resource individuals and families living in developed nations.[4] In the United States (U.S.), many Americans struggle to put healthful food on the table. According to Feeding America, the largest anti-hunger agency in the U.S., approximately 41 million Americans and 1 in 5 U.S. children experience food insecurity – the lack of consistent access to enough food for an active, healthy life – putting them at a greater risk of various forms of malnutrition and poor health.[5]

Preventing malnutrition in all forms is achievable through ensuring everyone has access to safe and healthful food, recognized as a high intake of fruits and vegetables.[6] Many in the international community believe that eradicating malnutrition and hunger is possible within the next generation.[7] The second Sustainable Development Goal set forth by the United Nations identifies that the right to proper nutrition is a fundamental right under international law.[8] This Sustainable Development Goal to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" pinpoints the inter-relationship between agriculture, poverty, food security, and health. This section will focus on how this inter-relationship, incorporating the four pillars of food availability, access, utilization, and stability, can be used in assessing and developing strategies that accelerate progress toward optimal health.

Measuring Food Security Status in the United States

The US Food Security Survey Module developed by the USDA Economic Research Service (ERS) utilizes a tiered approach to measure food security status of American households.[9] Food secure households are shown to have no or minimal anxiety about accessing adequate food and no changes to the quality, variety, or quantity of food utilized. Low food secure/ food insecure households have reduced quality, variety, and desirability of diets; but the quantity of food intake and normal eating patterns are not substantially disrupted. Households experiencing very low food security, also known as hunger, are shown to have disrupted eating patterns and a severe decline in both the quality and quantity of food intake at multiple points throughout the year.

Food security status is determined by a household's economic ability to afford food. The US Food Security Survey asks if, in the last 12-months, the household cut the size of meals, skipped meals, ate less than they should, or went hungry because there was not enough money for food [9]. The risk for food insecurity increases when money to buy food is limited or not available, and the most prevalent risk factor for food insecurity is poverty.[10]

Hunger-Obesity Paradox

An integral component of the multi-dimensional nature of food security is its implications on nutritional status. Food insecurity can lead to malnutrition and poor health due to decreased eating of healthful foods. All too often, overnutrition (overweight or obesity) and hunger exist within the same household, commonly referred to as the hunger-obesity paradox.[11]

Causes associated with the hunger-obesity paradox are the result of households that are low-resource facing unique challenges to adopting and maintaining healthful behaviors. For example, households with limited finances are forced to make trade-offs between food and other basic necessities such as housing, utilities, medicine, and transportation. Postponing medical care, cost-related medication underuse, and forgoing foods needed for special medical diets (i.e. diabetic diets) are common coping strategies that lead to poor health. Energy-dense, convenience foods that are filled with added sugars, fats, and refined grains are more popular with lower resource households due to lower cost. Food insecure households reportedly choose cheaper food, even though they know they are not the healthiest.[12]

In addition to the decrease in the accessibility of affordable healthful foods, low-resource communities have a higher density of fast-food restaurants[13], which predominantly offer a variety of energy-dense, nutrient-poor foods at relatively low prices. Research shows a diet rich in these foods is associated with weight gain and diet-related

diseases.[14,15] The financial and emotional pressures of food insecurity, coupled with low wage work, limited health care, inadequate transportation, poor housing, and neighborhood violence contributes to extremely high levels of stress and poor mental health for these households. Research has linked stress and poor mental health to weight gain and obesity through stress-induced hormonal and metabolic changes.[16]
The rates of food insecurity are significantly higher among historically disadvantaged communities. The high incidence is largely attributed to obesogenic food environments that include surroundings, opportunities, or conditions that promote obesity of a population.[17] Easy access to fast food restaurants and processed foods are common for predominantly black or Hispanic neighborhoods, where they are shown to have fewer full-service supermarkets and more fast food restaurants than their white counterparts.[18]

Achieving Nutrition Security

To achieve food and nutrition security, food must be (1) available, (2) accessible, (3) utilized, and (4) stable.[19] Defined by the World Food Programme, "Food availability is the amount of food that is present in a country or area through all forms of domestic production, imports, food stocks and food aid".[20] There is sufficient agricultural capacity across the globe to feed the world's population and the United States produces enough nutrient-dense food for all Americans.

Food access includes the physical, economic, and social means of obtaining food.[19] Lack of physical access is illustrated by a scenario in which food is being produced, but not distributed appropriately, due to inefficiency or lack of infrastructure. Specifically, urban, peri-urban, or rural low-resource communities have limited physical access to food due to a lack market channels to access fruits and vegetables due to fewer full-service supermarkets or grocery stores.[21]

Mitigating food waste is another contributing factor to food access. Nearly 40% of food in the United States goes uneaten and this preventable loss has profound effects on food security, the environment, and economy.[22] Food waste is estimated to cost $218 billion annually, approximately $1,800 for a four-person American household every year.[23] Recovering and repurposing pre-consumer waste from farms, restaurants, and other food distribution sites are shown to effectively reduce waste and promote healthful food access.

Understanding healthy food selection, preparation, storage, and sanitation are needed to ensure adequate utilization of food. Based on the World Food Summit, utilization includes having "safe, nutritious foods that meet dietary needs of all individuals".[24] It is both the way in which the body makes use of the nutrients and the household's food safety and preparation practices. Effective interventions to promote food utilization focus on empowering individuals and households with the knowledge, skills, and confidence to shop for and prepare healthy meals.[24]

The consistent stability of food availability, access, and utilization "at all times" is necessary to achieve nutrition security.[19] Scenarios that can disrupt stability include poverty, unemployment, increased food costs, adverse changes in climate, public safety, and political conditions.

Food Insecurity as a Social Determinant of Health

Factors in which individuals and communities live, work, and play are shown to influence health status, and health is determined in part by our social and physical environments.[25] Social determinants of health include access to healthful food (food and nutrition security); safe and affordable housing, access to educational, economic, and job opportunities; transportation; residential segregation; language and literacy; and availability of community-based resources in support of community living and opportunities for recreation. Physical determinants of health include the natural environment including green space; weather and climate; built environment--including sidewalks, bike lanes, and roads; exposure to toxic substances; and aesthetics such as good lighting.[25]

The U.S. Office of Disease Prevention and Health Promotion approaches the social determinants of health with a focus on five key areas:

- Economic stability – including employment opportunities, food and nutrition security, affordable housing, and poverty
- Education – including early childhood education and development, enrollment in higher education, high school graduation, and language and literacy
- Social and community context – including civic

participation, discrimination, incarceration, and social cohesion
- Health and health care – including access to health care, access to primary care, and health literacy
- Neighborhood and built environment – including access to foods that support healthy eating patterns (fruits and vegetables), crime or violence, environmental conditions and climate, and the quality of housing.[25]

The social-ecological model is a recognized framework for altering the five focus areas to promote healthy individuals, communities, and environments. The three core levels within the social-ecological model include macro (national legal system), meso (organization, communities, and ethnic groups), and micro (families, relationships, and individuals). The four-part food insecurity multi-dimensional index can be applied to all levels of the social-ecological model. **Figure 1** is a reproduction of the framework that was used to address food and nutrition security in rural Appalachia.[26]

The Social-Ecological Model (left side) and Corresponding Food Insecurity Multidimensional Index (right side)

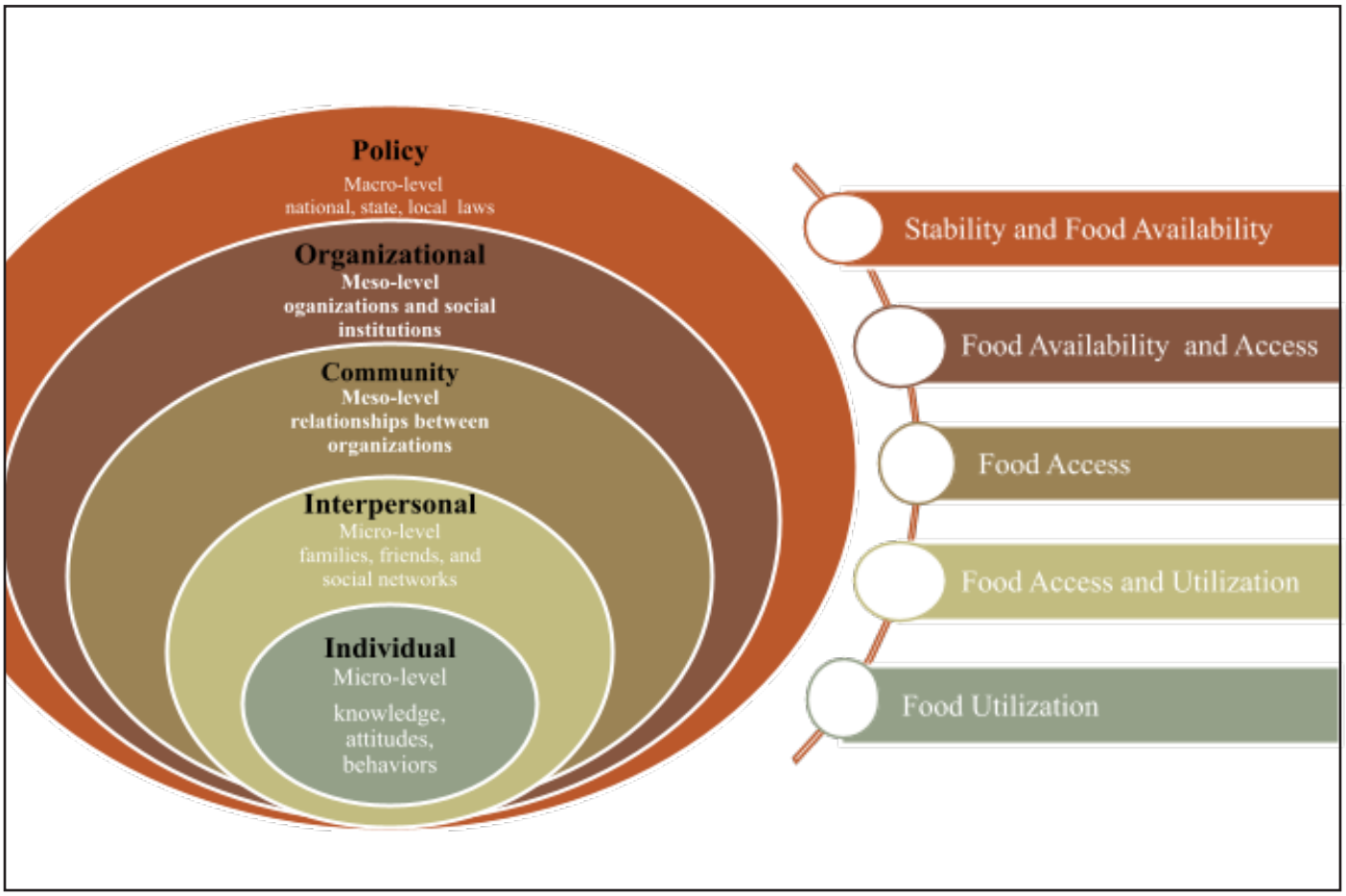

Figure 1. The authors received permission to reproduce this figure. The original source of the framework shown is from Hege, AS, Oo, K., Cummings, J. (2019). Current Nutrition-related Health Issues and Challenges, In Barth, M. (2019). Public Health Nutrition (ed), Springer Publishing. .

Connecting Policy and Food Availability

The United States Agriculture Improvement Act (commonly known as the 'Farm Bill') is the primary agricultural and food policy tool of the federal government.[27] Policies within the Farm Bill include factors that influence the type of food available within the country by offering subsidies that artificially decrease the cost of commodities (corn, wheat, and soybeans). Some argue that sustainable, regenerative agriculture practices that support small-scale farms, diversify production to include more fruits and vegetables, and strengthen resiliency (climate variability, natural disasters, or economic shocks) will contribute to improving dietary quality and overall health.[28]

Connecting Policy and Food Access

The Farm Bill also includes government safety-net programs that ensure adequate access to food for low-resource populations:

- Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps) – provide temporary benefits to low-income Americans to buy groceries on an electronic benefits transfer (EBT) card that works similar to a debit card at authorized retailers
- The Emergency Food Assistance Program (TEFAP) – provides USDA commodities to families in need of short-term hunger relief through emergency food providers like Feeding America Food Banks
- Commodity Supplemental Food Program (CSFP) – provides food assistance for low-income seniors through a monthly package of USDA commodities
- Child and Adult Care Food Program (CACFP) – provides prepared meals and snacks to children and adults in designated child and adult care centers
- National School Lunch Program (NSLP) – provides prepared lunch to qualified children during the school year
- School Breakfast Program (SBP) – provides prepared breakfast to qualified children during the school year
- Summer Food Service Program (SFSP) – provides prepared meals and snacks on-site to qualified children during the summer
- Women, Infants, and Children (WIC) – a prescriptive, non-entitlement program that supplies nutritious food for proper growth and development for pregnant and lactating women and children under the age of five

The following are additional safety net programs that can be implemented during a pandemic:

- Pandemic Electronic Benefit Transfer (P-EBT) Program – provides extra financial support to buy groceries for families of children who normally receive free and reduced lunch at school when schools are closed due to a pandemic
- Coronavirus Food Assistance Program (CFAP) – provides immediate financial assistance to farmers and ranchers impacted by COVID-19 by partnering with regional and local food distributers to purchase food from farms and distribute boxes of fruits and vegetables within the community

Connecting Organizations and Food Access

At the organizational level, Feeding America is the largest anti-hunger organization in the United States that works to ensure healthy food access for all.[29] The Feeding America national network includes 200 food banks and 60,000 food pantry and meal programs that provide food and services. Food Banks are non-profit organizations that collect and distribute food to direct hunger-relief programs. They act as food storage and distribution centers for smaller front-line agencies and usually do not give food directly to individuals and families struggling with hunger. The front-line agencies include food pantries, community meal sites, soup kitchens, mobile food distributions, and shelters. A food pantry receives food from a Food Bank and functions as the arms that reach out to the community directly.[29]

Connecting Individuals and Food Utilization

Nutrition education programs rooted in behavior change theory and human-centered design (a process that begins with the people in order to develop solutions that are tailored to their needs) are shown to be effective in addressing household and individual-level utilization food practices.[30] The USDA continues to explore programs that effectively encourage the consumption of healthy foods, such as SNAP-Ed that

offers strong nutrition education to change food behavior and improve health, specifically improving fruit and vegetable consumption for children and older adults, and providing shopping strategies and meal planning advice to help families serve more healthful meals.[31]

Applying the Framework in Appalachia: A Community-Academic Case Study

Communities in rural Appalachia experience higher rates of diet-related health disparities compared to other southern regions.[29] Appalachia includes a 205,000-square-mile region that follows the spine of the Appalachian Mountains including West Virginia; the eastern counties in Ohio, Kentucky, and Tennessee; the western counties in North Carolina; and the northern counties in South Carolina, Georgia, Alabama and Mississippi. The Appalachian Region's economy, once highly dependent on mining, forestry, and coal, has been continuously declining over the past decade. Residents of rural Appalachia have limited access to health care and high rates of food insecurity.[29] They are also less likely to report chronic disease.[32] and almost twice as likely to report their health as "poor or fair" than individuals not living in Appalachian, whether or not they have a current health condition or chronic disease.[33]

Despite this region's status as an agricultural community, many families still reside in areas with limited access to affordable, healthy food.[29] A large portion of the individuals and families in this region rely heavily on emergency food providers, such as food pantries, to supply their basic food needs. Nearly 90% of food pantries in western North Carolina were found to purchase inexpensive, higher fat and unhealthy food due to cost. Yet more than half of the food assistance recipients at these same pantries listed fresh fruits and vegetables as the category of food items they most desired.[34]

Purpose

Comprehensive strategies focused on reducing client dependency on services and shifting how the community connects food and health are shown to effectively address health disparities.[35] The purpose of this section is to describe the development of a community-academic partnership focused on innovative solutions to address food access and utilization in Appalachia. The partnership vision is to "have a deeply engaged community that has extensive resources and a culture of strength". The overall scope is to address the community's barriers to healthy food access, healthcare, and socio-cultural restrictions, in order to empower individuals, families, groups and leaders to enact policy and systems-based change.

Developing a Community-Academic Partnership

The National Institute on Minority Health and Health Disparities promotes the implementation of individual and micro-level strategies that include community-based, education approaches designed to reduce diet-related disparities in underserved populations.[35] Community-based participatory research has proven to be effective for collaborations between community and academic organizations resulting in positive outcomes. As such, forming community and academic partnerships is a way to address the public health disparities in Appalachia.[36] Concurrently, health-related professions, including programs with a focus on nutrition and dietetics, have a lack of professional practice sites for students limited in part by the geographic region, number of healthcare facilities, and willingness of clinical preceptors to mentor students.[37] The partnership described provides a creative solution to this challenge with a training opportunity that has local to global implications, including entrepreneurship and advocacy in non-profit work as a prospective career. Hands-on experience with evidence-formed solutions builds graduate student research repertoire, enhances the ability to provide culturally competent and sensitive care to a diverse population, and fosters the development of a passion for civic engagement. The fruits of all these endeavors have tremendous potential to reach the rural population on a new level of disease prevention, support innovation and self-sustainability of collaboration across the food system and empower community members.

The core partners include the following agencies based in Boone, NC:

- Hunger and Health Coalition (HHC) – established in 1982, HHC is a food pantry that addresses and alleviates the effects of poverty in Watauga County, NC. Eligibility for all services is based

on the USDA requirements for federal food assistance recipients—clients must be at or below 200% of the Federal Poverty Level. According to a 2014 study by Feeding America, 72% of Watauga County meets this criterion for assistance. Nearly 30,000 people received assistance through the their "food box pantry" program each year, a third of whom are children.

- Department of Nutrition and Health Care Management at Appalachian State University (ASU) - ASU is a mid-sized master's granting institution with more than 18,000 students, about 1700 of those being graduate students. The nutrition and health care management department is housed within the Beaver College of Health Sciences. The undergraduate and graduate programs predominantly prepare graduates for careers in food, nutrition, and dietetics with an emphasis on those aspiring to achieve the Registered Dietitian Nutritionist (RDN) credential.
- Appalachian Regional Healthcare System (ARHS) – the leader for healthcare in the High Country, committed to promoting health. The hospital system includes two hospitals that offer 117 beds at the primary hospital in addition to thirteen medical practices across the area.

HHC has long sought to make data-driven decisions regarding the needs of clients, going beyond a reliance on traditional means of assistance through things like prepared boxes of food and selected prepared meals. Thus, HHC turned to two critical partners in its search for solutions: the Department of Nutrition and Health Care Management at Appalachian State University (ASU) and the Appalachian Regional Healthcare System (AHRS). The data-driven experiences that each partner provided, based in part on feedback from clients and the community, hastened and informed a desire to combat health disparities.

Beginning in 2015, graduate students in nutrition spoke with clients at the HHC to collect information about how the clients felt services could be improved and expanded. Responses indicated an overwhelming desire for healthier food options and nutrition education services, as well as improved decision-making regarding meal planning. Nearly all clients expressed awareness that they need to make healthier food choices, both for themselves and for their families, but added that they lack the knowledge needed to improve food choices.

Simultaneously, ARHS began to track the correlation between food insecurity and in-patient hospitalizations and emergency department visits for acute and chronic disease. This trend was confirmed by registered nurses and social workers who began completing food insecurity questionnaires with their patients in conjunction with guidance from the HHC. The link between food insecurity and a general lack of awareness about which foods are appropriate for managing chronic illnesses became increasingly apparent.

As a result, HHC began partnering with ARHS in August 2017 to create a program that provides emergency food for patients screened as food insecure in an effort to develop solutions for providing healthier foods to the community's low-resource populations and to provide family-based nutrition education that creates lasting behavior changes in food preparation and consumption, impacting generations to come. The first step in accomplishing this goal was to establish a relationship with these new clients, done primarily through the provision of healthy foods during the first contact.

Community Centered Health Initiative

In 2014, BlueCross Blue Shield (BCBS) began Community Centered Health, an initiative that supports collaborations between clinical and community organizations to form a better understanding of, and act on, non-medical drivers of health outcomes. Community Centered Health is a way for BCBS to support North Carolina and develop ways to combat the root causes of health disparities while acknowledging that health is more than what occurs in a doctor's office and can stem from many outside determinants.[38]

Members of the partnership commit to identify any relevant information or data in relation to individual or organizational work that would support the Community Centered Health program. The partners have agreed to be advocates for the Community-Centered Health Project and will share information about the program and Community Centered Health model with their respective organizations, clients/patients, and the broader community. Committed to influencing the entire social-ecological model, the successes can be leveraged within clinical and organizational partnering agencies

in order to support policies and influence formidable change. The commitment includes identifying and addressing inequities that have been identified in the community by engaging and supporting community members most impacted by these inequities.

Target Population

The partnership took place in Boone, NC within Watauga County. This area has historically been a traditional Appalachian farming community. The two largest employers are Appalachian State University and Appalachian Regional Healthcare System.

According to the 2010 Census data [39], the current population make-up of Watauga county's 51, 079 residents is 94.5% White, 1.7% African American, and 3.4% Hispanic or Latino. Watauga county holds the 3rd highest poverty rate in North Carolina, paired with a high cost of living related to an economy based on tourism and its home to a mid-sized state University. Food insecurity rates overall and among children are greater than state averages. Thirty-two percent of residents have no health insurance and 59% are food assistance recipients. The local food bank reports an upward trend to 36 new families seeking assistance each month. Several nonmedical drivers, or social determinants, of health (SDOH) including poverty, transportation, housing and education are related to rates of food insecurity, obesity and chronic disease. Access to healthy foods, choices for healthy eating, and disease prevention and management are priority areas identified by community needs assessments. The Community Health Assessment of Watauga County reports that The Hunger and Health Coalition and the Community Care Clinic of Boone, NC, have a significant client base with biochemical indicators associated with obesity, metabolic syndrome, and chronic disease (23% with diabetes, 43% with hypertension, 32% with high cholesterol, and 16% with both diabetes and hypertension).[34] When someone experiences one disparity, a number of other pressures perpetuate this cycle creating additional health, wellness, and emotional concerns. Poor food choices and the economic realities that lead to them are connected in significant ways to individuals' health. As the home to Appalachian State University (ASU), the county also suffers from food insecurity among its student population. In fact, the rate of food insecurity at ASU has been documented to be as high as 46%.[40]

Identifying the Need through Community Forums

Engagement with the community is essential to hear what community members feel is necessary to make a shift in food insecurity and poor health outcomes. During the planning period, the team engaged and partnered with community members through a number of activities. Data from hospital partners identified specific micro-communities in Watauga County as high utilizers of the emergency room for poorly managed chronic diseases (e.g., diabetes). This initial hospital data and the ongoing food security screenings facilitated intentional relationship building with members of these communities.

A series of community cookouts were held in the identified micro-community to learn about community members' concerns. The cookouts were hosted in partnership with trusted and well-known community members, without any agenda but building relationships and trust with neighbors.

In response to feedback gleaned at the cookouts, the partnership continued to explore barriers within the low-resource community by coordinating community forums. A series of 4, 2-hour forums were held with 24 families. The forums were conducted over a four-week period. During the third week, participants were invited to a local catering kitchen and participated in a healthy cooking demonstration. Each household went home with enough supplies to recreate the meal with their family. Almost half (44%) of the participants were Spanish speaking. Each session included a community meal for participants and their families, childcare during the focus group portion of the evening, and a 30-pound box of produce provided to each family. Participants provided valuable insight into what the residents of these communities need in order to feed themselves and their families healthful meals and break the chain of ongoing food and nutrition insecurity. This diverse group helped inform the top challenges of those who experience food insecurity in Watauga County.

The community forums provided information regarding where participants have been shopping, transportation methods, how they make their budgets stretch, and additional benefits or services they are using in order to provide food for their families. Results showed that community members prefer fresh over canned produce and would like to see more culturally appropriate food items available in their food boxes (100%). Almost half (46%) of the

participants explain that they did not buy unfamiliar produce because they do not know how to prepare it. Families find it particularly difficult to meet food needs during the winter due to transportation, seasonal work that limits financial resources, and a desire for special foods on holidays. Individuals were very clear in sharing concerns about their overall health and nutrition. The majority (90%) of the participants were interested in nutrition counseling offered at HHC and more than half of those preferred group counseling over individual sessions.

Improving Healthy Food Access

Findings from the community forums led the team to consider additional ways to support clients and community members through promoting healthy food access and improving utilization through nutrition education. HHC has made efforts to shift donation requests to include more nutrient-dense, disease-friendly options, fresh produce, and cultural foods. Aside from strong relationships with local farmers, they have worked to procure additional sources of regionally located produce. Shifts in budget priorities have also reflected the purchase of fresh and culturally appropriate foods.

A **Simple Gesture** is a nutrition-focused food donation program that engages the entire community. The program is designed to make food pantry donations simple by organizing volunteer drivers to pick up the donated items right from the doorsteps of community residents. Donors are given a reusable bag that contains a list of requested healthy items to donate. Pick up days occur every eight weeks. Food bags are brought back to HHC where volunteers begin the sorting process to redistribute food to its clients. This program has raised nearly 10,000 pounds of food at each pick-up day and offers the opportunity to target donations to meet client preferences.

The coordination of Quantity Food Production experiences for students in the Nutrition Program at ASU led to a greater number and variety of **healthy take-out meals** available for clients. For students, this experience involves creating a protocol for developing menus, sourcing ingredients, cooking, storing and distributing a variety of freshly prepared 'grab and go' refrigerated and frozen entrees, and donated food ingredients as well as analysis and development of workflow in the food production area. Cooking demonstrations and samples of healthy recipes on a budget have also been offered in conjunction with the nutrition education initiatives. Preliminary results among students support benefits to rich experiences in personal interaction and engagement in the nonprofit setting compared to other food production learning sites on-campus.

The food distribution area of HHC was renovated in 2018 with the goal of implementing a **client-choice food distribution system**, where clients self-select food box items, much like a grocery store, within established allocation guidelines for family size. The renovation included a new layout that would make client shopping possible, and new shelving with specific shelves designated for disease-friendly foods such as low-sodium, and gluten-free options. Barriers such as staff resistance, space limitations, hours of operation, and food supply precluded full implementation of this distribution method.[41] A transitional system with a pantry order form was used in the meantime so clients could still have some choice and a more dignified experience when obtaining food assistance. Because of the encountered barriers, full implementation and evaluation of outcomes related to client satisfaction and self-efficacy were not achieved. Follow-up research regarding the benefits and barriers to client-choice operations was conducted to identify potential next steps in bringing this system to full realization and to benefit others who may desire this transition. The findings indicated that various pantry-specific factors including hours of operation, number of staff and volunteers, and facility layout all influence the way a client-choice pantry can be operated and that the ordering system may, in fact, be a best option for some facilities.[42] Staff buy-in and training was also a significant factor in moving forward in this direction.

Renovation of the food pantry to include a **Fresh Market** space included merchandising, marketing, and inventory management strategies to enhance the overall quality and presentation of healthy food. Nutritional "nudging" has been shown to encourage clients to select more nutrient dense foods such as produce and legumes.[43] This was incorporated through the provision of bilingual nutritional value signage, sample recipes, a "personal shopper" to assist families in making improved food selections, and repositioning of sweets and baked goods so that they were not at the front and center of client view. Interestingly, formative research on the Fresh Market shows that the clients utilizing it were

more food insecure than clients not participating. Additionally, clients participating in more services offered by HHC reported lower self-efficacy, demonstrating that the services are truly reaching those in most need.[44] Clients also rated self-efficacy lower for planning ahead and higher for making decisions in the moment, signaling a need for future interventions to focus on meal planning for the near and far future as well as evaluating self-efficacy over a longer period of time.[44]

To improve healthy food access for individuals accessing healthcare through the emergency department at the hospital, ARHS incorporated a 2-question food security screening to their emergency room patient screening protocol in 2017. The hospital committed to this change at a system-wide level by incorporating the screening into their Electronic Medical Records (EMR) as well as educating physicians and staff on the prevalence of food insecurity and its adverse effect on health. If a patient is identified as food insecure, the hospital provides an emergency medically-tailored food box and the health care provider refers them to HHC. The health care providers also "prescribe" certain foods that individuals can receive at HHC to address obesity and diet-related chronic diseases. Students have collaborated in the development of recipes for food box items and the development of counseling and screening materials to be used with clients.

Improving Food Utilization

Efforts were aimed at branding a nutrition team at HHC to improve food utilization by offering **nutrition education** at HHC. This has taken several forms over the years, including the following methods:

- A 6-week waiting-room education series where brief targeted lessons were provided as clients waited in line for pharmacy services. Preliminary results supported increases in knowledge and self-efficacy for clients, but there were barriers regarding time for clients to fully engage.[45]
- Nutrition interns offered tours to food pantry clients at the HHC facility and provided assistance with food choices.
- A registered dietitian and graduate students were available for regular office hours to provide nutrition education and counseling for clients with diet-related diseases.
- The Cooking Matters Program (Share our Strength) is also being delivered in collaboration with Second Harvest Food Bank of Northwest North Carolina. In 1993, the Cooking Matters campaign began teaching parents and caregivers to shop for and cook healthy meals on a budget. Food skills education is practical education that teaches individuals to prepare food that meets their nutrition, budget, and personal needs. Cooking Matters works to help end childhood hunger through empowering families to make healthy and affordable food choices.[46]
- Nutrition education has also taken the form of written materials, SNAP meal plans, recipes to accompany food boxes, and video demonstrations.

Preliminary Outcomes

Partnerships with ASU and ARHS have helped HHC to engage people throughout Watauga County who were unaware that they were eligible for services or may not have known to ask for assistance. Combined efforts have created a broader safety net for those in need and have, at the same time, engaged key stakeholders who are examining the issues related to food insecurity from a broader perspective. Preliminary results support positive benefits for client nutrition knowledge and self-efficacy as well as positive perceptions of initiatives indicated by clients, staff, and students. The work helped identify specific barriers in moving forward to full implementation and success. Making nutrition convenient, tasty, and relevant through internal policies and procedures was shown to increase access and interest in the produce for HHC clients.

Advantages and Challenges to the Partnership

The partnership enhances collaborative effort rather than individual entities engaging in similar work, as well as synergy from the collective energy and passion for serving the most vulnerable in our community. Advantages of this partnership include the potential for continued funding based on the strong partnership that has been developed. The relationship building toward a common goal builds capacity for greater advocacy and leverage for wide-spread policy change.

Challenges have included the uncertainty of

onboarding potential new team members given the success of the core team. One strategy for moving forward to grow partnership potential has been the development of a rules of engagement document and memorandums of agreement between each entity in the partnership. Another potential challenge in any partnership is clear communication regarding the roles and responsibilities of each partner such that no partner is carrying an overly burdensome level of responsibility. Clearly outlining expectations can help mitigate the risk of a misunderstanding, as can regular communication among the core team about partner directions and efforts toward reaching common goals.

There are potential challenges to this work as the partnership moves toward mobilization of the community, including its members and leaders. Since it is a primary election year, there is the potential that leadership will change at all levels. Continuing to engage local leaders, candidates, current policy makers and community members on what it means to live and work in Watauga county, including currently available opportunities as well as barriers to accessing those opportunities and services, will be increasingly important. The partnership aims to offer multiple opportunities for public discussion and education. These discussions and forums represent the voice of the individuals experiencing low socioeconomic status and elected leaders who are shaping the policies.

Future Opportunities: Moving toward Stability in Healthy Food Access

Moving forward, major performance indicators include 1) awareness, identification of, and connection with local resources for food insecurity, evidenced by a decreased rate and severity of food insecurity in Watauga County; 2) improvement in intake of healthier food options for preventing and managing chronic disease, evidenced by improved health indicators, and 3) policy changes that increase sustainable housing options as a social determinant of health. Table 1 illustrates how these indicators will be targeted and measured.

Additional Resources

https://www.hsph.harvard.edu/nutritionsource/sustainability/

https://www.paho.org/salud-en-las-americas-2017/?p=67

https://www.un.org/sustainabledevelopment/

https://www.ted.com/talks/michael_green_the_global_goals_we_ve_made_progress_on_and_the_ones_we_haven_t

https://www.youtube.com/watch?v=a5xR4QB1ADw

https://www.ted.com/talks/jude_wood_building_a_resilient_community

https://www.who.int/initiatives/decade-of-healthy-ageing

https://www.jeffsachs.org/

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Table 1. Theory of Change Table Guiding Partnership Work

Inputs	Activities	Outputs	Outcomes	Impacts
Nutrition Education	• Nutrition education and cooking classes • Counseling • Personal shopping assistance	• Number of clients attending education events and receiving consultations	• Percentage of participants with increased nutrition knowledge, food preparation skills, self-efficacy, and eating behaviors.	• Improved food security, eating behaviors, and management of chronic disease
Food Security Screening	• Screenings in all ARHS offices • Rx for Food Box and fresh produce	• Number of patients referred and connecting with local food resources	• Improved food security and disease management	• Reduced number of hospital admissions and readmissions
Food Sourcing	• Review and revise pantry business model and policy to increase variety of cultural and disease appropriate food items • Increase connections with local businesses, farmers, Second Harvest Food Bank	• Organizational policy and fiscal resources dedicated to increasing % of fresh produce • Number of cultural and disease appropriate food items.	• Adoption of pantry policy to increase % fresh produce, and cultural and disease appropriate food items • Dedicated space and fiscal resources to supply expanded food variety • Client satisfaction	• Internal and external policy shift to improve pantry food environment
Housing	• Research and development of policy recommendations for equitable housing solutions • Plan and host forum to educate policy makers	• Stakeholder discussions to identify equitable housing solutions • Percentage of housing sector stakeholders in attendance at forum events and educated about policy proposals • Finalized equitable housing solutions policy white paper and recommendations for housing sector	• Change in housing sector knowledge regarding equitable housing solutions number of new housing sector policies aimed and adopted for achieving equitable housing standards • Increase in affordable housing in the community	• Improved housing regulations and affordable, equitable housing options

Over the short and long-term, the partnership action steps will focus on growing the community-clinical partnership, influencing policy, systems and environmental change, and ultimately leading to a clinical shift. Tables 2-4 present action plans at the community, organizational and policy level with a timeline for each goal. The partnership aims to host a community education summit entitled "Refocus Watauga 2020" to disseminate the information from community forums, with the goal of shaping policy supports and recommendations for town and County policy makers.

Table 2. Action Plan: Individual and Community-Level (Food Access and Utilization)

Action	Anticipated Outcomes	Timeframe
Expand food security screening to all ARHS offices and 10 non-ARHS offices	Increased: • Number of offices implementing screening and referral system • Number of patients screened and referred monthly • Number of patients connecting with local food resources upon referral • Reduced number of hospital admissions and re- admissions	12-18 months
Increase awareness of food insecurity and other barriers to wellness in the clinical community	• Increased awareness in the medical community about the connection between food insecurity and how that impacts overall health	12-18 months ongoing
Expand community nutrition education opportunities	• Increased number of clients attending consultations and education events • Improved nutrition knowledge, food preparation skills, self-efficacy, eating behaviors, and chronic disease management	Ongoing

Table 3. Action Plan: Organizational Level
(Food Availability and Access)

Action	Anticipated Outcome	Timeframe
1. Incorporate SDOH screening in the ARHS Electronic Medical Records	• System wide integration of SDOH screening in the Electronic Medical Record • Increased tracking of barriers for patients and trust between patients and physicians • Decrease in unmanaged chronic disease with earlier detection of disease	18 months – ongoing
2. Implement physician referrals for fresh produce through prescriptions	• Physicians identifying access to healthy food as instrumental to habit and health change • Provision of prescriptions for nutrient dense food through HHC • Increase in positive patient interactions and trust with physicians and outside safety net services • Increased positive outcomes for diet related management of disease	18 months- ongoing
3. Inform research, creation, and implementation of policy at the local, regional and state level	• Informed policy approach internally at ARHS regarding SDOH and understanding of the impacts of these policies on clinical well being • Members of the ASU and ARHS systems actively participating in data gathering to inform the research, creation and implementation of policy at the local, regional and state level	2-4+ years
4. Develop policy surrounding nutrition counseling referrals through HHC pharmacy.	• Policies for identifying clients with chronic disease that would benefit from increased nutrition education and increased access to fresh food for diet related management of disease	6 month-ongoing
5. Shift HHC policy regarding partners and purchasing of local produce and culturally appropriate offerings.	• Incorporation of diversified food procurement in order to address the nutrition and cultural appropriateness of food being distributed through the HHC	6 month-ongoing

Table 4. Action Plan: Policy-Level (Stability and Food Availability)

Action	Anticipated Outcome	Timeframe
1. Lobby Second Harvest Food Bank to change procurement and distribution system	• Diversified purchasing and offerings for the Second Harvest network serving Central to Western NC	12 months
2. Host Refocus Watauga 2020, "State of Watauga" education and information session for candidates, policy makers, educators, local leaders and community members	• Increase in community and policy maker awareness, policy maker advocacy for increased access to services for community members, willingness to receive policy suggestions	6 months, ongoing - annually
3. Create policy suggestion document for local and regional leaders, specific to SDOH and barriers identified through community engagemen	• Community informed policy suggestions that increase equitable access to food, housing, transportation, education and health care for all residents	1 year - ongoing

The community-academic partnership model could be expanded to public-private partnerships regionally and nationwide, and data gathered will be very valuable in demonstrating the efficacy of this program model to improve health care for diet-related conditions among low-resource, uninsured populations.

Practice Applications

- Malnutrition, food insecurity, and hunger all too often occur within the same communities and households.
- Largely attributed to a lack of financial resources, food insecure communities experience social and physical challenges to living a healthy life.
- Achieving optimal nutritional status is possible through food 1) availability, 2) accessibility, 3) utilization, and 4) stability.
- The greatest opportunity for creating change is building on established community partnerships to reach all individuals and families in need.
- Strategic academic-community partnerships have the potential to bridge the gap between food insecurity and chronic disease in rural Appalachia.

Conclusion

Social, economic, and environmental factors have a profound impact on nutrition-related health outcomes and call for integrated, system-based approaches.[25] Community-academic partnerships offer a unique opportunity to address food insecurity as a social determinant of health. Community partners are trusted organizations by individuals and families in need and provide a breadth and depth of experience and understanding of the health-related challenges experienced by members of the community. Academic institutions offer expertise in research and program evaluation in addition to providing skill-based reliable interns and volunteers. Health care facilities and hospitals are at the forefront in addressing common health inequities. Adequate food for health is not merely a promise to be met through charity; it is one to be fulfilled through appropriate actions by governments and non-state agencies. By connecting the dots between academia, non-profits, and hospitals, communities can develop sustainable approaches that decrease chronic disease and promote health for all, now and in the future.

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Sustainable Aging: Building an Age-Friendly Rural Community

Kim C. McCullough and Erin D. Bouldin

The practice of successful and sustainable aging recognizes that communities must be intentional in efforts to positively affect the lives of older people. The primary aim of this article is to present one approach to sustainability in aging: the concept of age-friendly communities, which focuses on optimizing opportunities for health, participation and security in order to enhance quality of life as people age. Features of age-friendly communities include accessible transportation, affordable appropriate housing options, inviting outdoor spaces, quality community and health services, employment and volunteer opportunities, and access to social activities and public events. This article reviews several principles of the age-friendly framework and discusses how this global initiative can be translated into rural communities. Examples of ongoing efforts in Watauga County, North Carolina that seek to leverage resources from community-based organizations and agencies and a university to build sustainable support for people as they age are provided. Building age-friendly practices in rural communities has the potential to sustain the health and well-being of older adults as well as the communities in which they live.

Introduction

Americans are aging rapidly. According to the US Census Bureau older adults are projected to outnumber children by the year 2034.[1] And, life expectancy will increase from 79.7 years in 2017 to 85.6 years in 2060.[2] Generally, most older people live in urban areas. However, older adults make up 17.5 % of rural areas compared to 13.8 % of urban areas.[3] Nearly half of the older adult population (45.9%) lives in the rural south.[3] And, the number of older adults in rural communities is increasing. In North Carolina, the 65 and older age group is projected to increase by 61% over the next two decades.[4] As people age, they want to remain active and relevant in the communities where they live.[5] However, growing old in rural areas provides different challenges than experienced large metropolitan areas. In order for rural communities to sustain their aging population they must intentionally evolve and expand to provide systems and opportunities for the health and wellness of older people.

Creating a community that prioritizes sustainable aging begins by understanding what older adults need from their communities. The term sustainability is a broad concept that focuses on improving the present quality of life without compromising future quality of life. The three domains of sustainability are economic, environmental, and social.[6] Economic sustainability can be viewed as the ability of older adults to support themselves and meet the financial obligations for their healthcare needs. This paper will focus on the concept of social sustainability which combines design of physical and social environments.[6] Sustainable aging can be considered as an important extension of the social sustainability concept. In fact, researchers have identified aspects related to physical and social environments that promote longer and healthy lives as people age. In 2004, Buettner and colleagues identified communities around the world where people reach age 100 at rates 10 times greater than in the United States. These communities were dubbed as "Blue Zone" communities and their citizens generally live longer and healthier lives than most areas throughout the world.[7] Based on their observations, environmental and social factors were identified as key aspects that promote sustainable aging in these communities. These factors include the following: environments that promote natural movement, having a sense of purpose, being able to relax and minimize stress, eating a mainly plant

based diet while avoiding overeating, spending time with family and active involvement in faith-based communities. Lastly, people in these communities surround themselves with people who support healthy behaviors.[7] Using these key factors, recommendations were developed for other communities looking to improve the quality of life for their residents. These recommendations include creating an environment that makes being active a safe and easy option, increasing social networks by strategically bringing together individuals who are committed to healthy lifestyles, getting people involved in volunteering and encouraging them to define a sense of purpose.

Understanding that the physical and social environments in which one lives determines the health and well-being of an individual is an important first step. And, not surprisingly, the recommendations from the "Blue Zone" communities align with the social determinants of health for older adults. These are having access to community-based prevention resources, proper nutrition, transportation, and increased levels of social support systems.[8] Older adults who have access to these resources often are at a lower risk for both physical and mental illness and are more likely to age well. The Centers for Disease Control and Prevention (CDC) recommends that community organizations work collaboratively to ensure that communities get active participation from many sectors of the community.[9]

In order for any of the above recommendations to have a positive impact on sustainable aging, leaders within rural communities must actively work to change the way many people think about aging. Negative stereotypes related to aging such as deterioration and dependency are pervasive. This type of thinking serves to devalue the contributions that older adults provide to communities. The Gerontological Society of America (GSA) has implemented and created resources for a "Reframing Aging Initiative." This initiative and others like it (e.g., AARP Disrupt Aging initiative) aim to change traditional attitudes about aging in the United States. Rather than viewing aging as a time of decline, these initiatives encourage communities to collectively view aging as an opportunity to capitalize on the experience and wisdom of older adults. The strengths and talents older adults bring can be channeled into new interests and opportunities that benefit the community as well as the older adult.[10]

Identifying strategies to assist rural communities in planning and securing the necessary resources to implement and sustain practices that promote health and well-being is essential. Creating a community that is aging friendly requires leadership, planning, strategic partnerships and development of a supportive and sustainable infrastructure. The Age Friendly framework developed by the World Health Organization (WHO) provides recommendations for implementation. And, although several counties in North Carolina have created age-friendly plans, there is much work to be done.

What is Age Friendly?

Age-friendly communities recognize the different needs of all their residents over time. The concept of age-friendly cities grew out of WHO's active aging framework, which focuses on maximizing quality of life as people age.[11, p.5] Active aging is influenced by both personal factors and behaviors as well as economic and social determinants, the availability of health and social services, and the physical environment.[11, p.5]

Eight Domains for Age-Friendly Communities

The domains that contribute to an age-friendly city were developed based on the scientific literature and on interviews with nearly 1,500 older adults (people age 60 years or older), 250 caregivers of older adults, and 515 service providers for older adults living in one of 33 cities around the world. Interviews focused on features of communities and systems that enabled older adults to participate, maintain their health and quality of life, and feel safe and secure. Participants also identified problems and barriers they encountered and suggested changes that might improve their environments. The following figure illustrates the 8 domains identified through this process: transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, community support and health services, and outdoor spaces and buildings.

HIGH COUNTRY AREA AGENCY *on* AGING

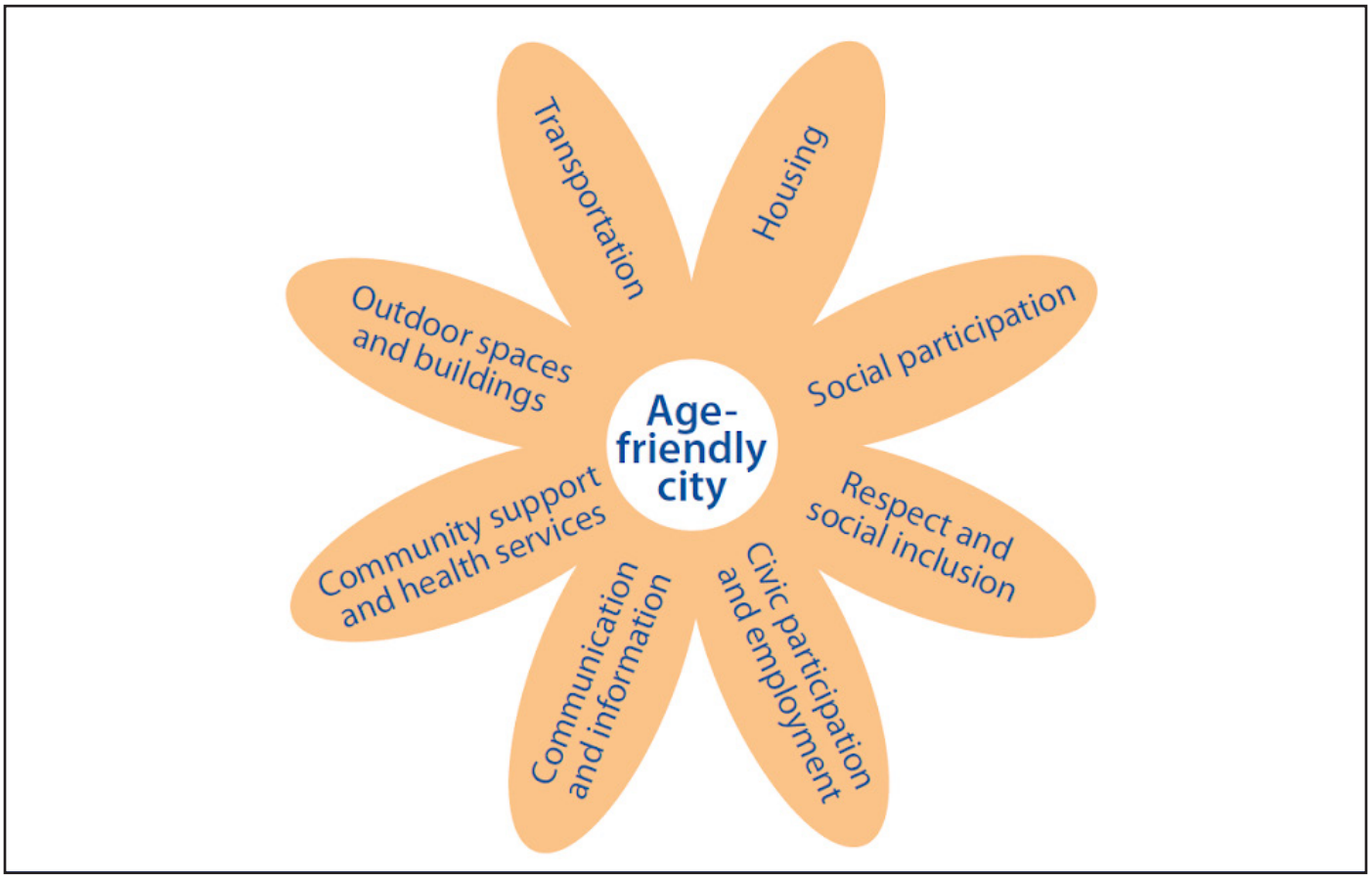

Figure 1. Eight domains for age-friendly cities. Source: WHO Global Age-Friendly Cities Guide11

In addition to identifying these domains, the WHO also developed checklists for each one based on the focus groups it conducted. We highlight four of these domains below as examples of actions that communities can take to make them more age-friendly. Note that some activities, while listed in a particular domain, could have effects in multiple domains since they are interrelated.

Community Support and Health Services

Health services, ranging from preventive services such as vaccines and physical and mental screening to tertiary care including surgical intervention and rehabilitation, are a vital component of supporting people as they age. Older adults, like younger adults, need access to high quality, affordable health services.[12] Meeting this standard is particularly important for older adults who both utilize services more frequently[13] and more often live on low- to moderate-incomes[14] than their younger counterparts. In addition to formal health services delivered through clinics, hospitals, and other traditional clinical settings, supports for home- and community-based services (HCBS) should be available and accessible to older adults.[12] HCBS encompass a broad range of programs and services, including in-home nursing or personal care assistance, meal delivery services, housekeeping, and respite care for family caregivers.

While the delivery systems for programs in clinical or community-based settings vary widely and are funded by multiple payers (federal, state, and local government, private sector, and non-profit or community-based organizations) in the US, WHO has identified three broad approaches that will better serve the needs of older populations:

1. Develop and ensure access to services that provide older-person-centered and integrated care;
2. Orient systems around intrinsic capacity;
3. Ensure there is a sustainable and appropriately trained health workforce.

Age-friendly Checklist: Overview of Community Support and Health Services[11]

Accessible Services
• Health and social services are well-distributed throughout the community, are conveniently co-located, and can be reached readily by all means of transportation.

Range of services
• An adequate range of health and community support services is offered for promoting, maintaining, and restoring health.

Voluntary support
• Volunteers of all ages are encouraged and supported to assist older people in a wide range of health and community settings.

Emergency planning and care
• Emergency planning includes older people, taking into account their needs and capacities in preparing for and responding to emergencies.

A more comprehensive Age-friendly Checklist in regards to Community Support and Health Services[11] includes the following:

Accessible Services
- Health and social services are well-distributed throughout the community, are conveniently co-located, and can be reached readily by all means of transportation.
- Residential care facilities, such as retirement homes and nursing homes, are located close to services and residential areas so that residents remain integrated in the larger community.
- Service facilities are safely constructed and are fully accessible for people with disabilities.
- Clear and accessible information is provided about the health and social services for older people.
- Delivery of individual services is coordinated and with a minimum of bureaucracy.
- Administrative and service personnel treat older people with respect and sensitivity.
- Economic barriers impeding access to health and community support services are minimal.
- There is adequate access to designated burial sites.

Range of services
- An adequate range of health and community support services is offered for promoting, maintaining, and restoring health.
- Home care services are offered that include health services, personal care and housekeeping.
- Health and social services offered address the needs and concerns of older people.
- Service professionals have appropriate skills and training to communicate with and effectively serve older people.

Voluntary support
- Volunteers of all ages are encouraged and supported to assist older people in a wide range of health and community settings.

Emergency planning and care
- Emergency planning includes older people, taking into account their needs and capacities in preparing for and responding to emergencies.

Social Participation

Being able to participate fully in one's community includes connecting with other members of the community in their homes and in public, being able to attend cultural and religious activities and events, and moving around the community for leisure. Greater social participation is connected to better health and quality of life outcomes across the lifespan,

including for older adults.[16,17] The converse of social participation, social isolation, is increasingly being recognized as a risk factor for poor health outcomes, particularly among older adults.

Since social participation itself involves a multitude of activities, the checklist for this topic area is quite broad and overlaps with many of the other domains for age-friendly cities. For example, transportation to events or to others' homes is a necessary component of ensuring social participation.

Age-Friendly Checklist: Overview of Social Participation[11]

Accessible events and activities
• The location is convenient to older people in their neighborhoods, with affordable, flexible transportation.

Range of events and activities
• Community activities encourage the participation of people of different ages and cultural backgrounds.

Event facilities and settings
• Facilities are accessible and equipped to enable participation by people with disabilities or by those who require care.

Promotion and awareness of activities
• Activities and events are well-communicated to older people, including information about the activity, its accessibility, and transportation options.

Addressing isolation
• Organizations make efforts to engage isolated seniors through, for example, personal visits or telephone calls.

Fostering community integration
• Community facilities promote shared and multipurpose use by people of different ages and interests and foster interaction among user groups.

A more comprehensive Age-friendly Checklist in regards to Social Participation11 includes the following:

Accessible events and activities
- The location is convenient to older people in their neighborhoods, with affordable, flexible transportation.
- Older people have the option of participating with a friend or caregiver.
- Times of events are convenient for older people during the day.
- Admission to an event is open (e.g. no membership required) and admission is a quick, one-stop process that does not require older people to wait in line for a long time.

Affordable
- Events and activities and local attractions are affordable for older participants, with no hidden or additional costs (such as transportation costs).
- Voluntary organizations are supported by the public and private sectors to keep the costs of activities for older people affordable.

Range of events and activities

- A wide variety of activities is available to appeal to a diverse population of older people, each of whom has many potential interests.
- Community activities encourage the participation of people of different ages and cultural backgrounds.

Event facilities and settings

- Gatherings occur in a variety of community locations, such as recreation centers, schools, libraries, community centers in residential neighborhoods, parks and gardens.
- Facilities are accessible and equipped to enable participation by people with disabilities or by those who require care.

Promotion and awareness of activities

- Activities and events are well-communicated to older people, including information about the activity, its accessibility, and transportation options.

Addressing isolation

- Personal invitations are sent to promote activities and encourage participation.
- Events are easy to attend, and no special skills (including literacy) are required.
- A club member who no longer attends activities is kept on the club's mailing and telephone lists unless the member asks to be taken off.
- Organizations make efforts to engage isolated seniors through, for example, personal visits or telephone calls.

Fostering community integration

- Community facilities promote shared and multipurpose use by people of different ages and interests and foster interaction among user groups.
- Local gathering places and activities promote familiarity and exchange among neighborhood residents.

Communication and Information

As noted in the preceding section, providing older adults a welcoming opportunity for participation is critical to their inclusion in civic life. Advances in communication via mobile devices, the Internet, and even in various in-person settings like community organizations have the potential to enhance communication and the dissemination of information. However, inattention to the details of familiarity with, access to, and use of these various technologies and spaces among older adults might result in their exclusion. Based on the World Health Organization's focus groups, older adults tended to value direct communication via in-person or telephone communication, especially through trusted informal networks. They also generally expressed support for information from organizations like community centers, libraries, and doctor's offices. Information may be provided at existing events where older people are likely to be, or events may be created with the intent to share information with key community members to increase the likelihood of dissemination to other older adults across the community. Regardless of setting, reaching older adults who are socially isolated and have small networks that are not connected to other groups is a challenge.

Information must be both timely and relevant to be most useful, so reaching older adults on both a regular basis and at critical time points--such as leading up to retirement, upon moving, at the time of diagnosis with a chronic health condition, or around the time of loss (e.g., of a partner or of function)--might be most useful. Dedicated helplines or printed columns in local newspapers can provide this information to older adults, and greater efforts can be implemented across organizations, service providers, and community members to consider and focus on the needs and potential interests of older adults when announcing events and programs.

Additional Resources

https://www.hsph.harvard.edu/nutritionsource/sustainability/

https://www.paho.org/salud-en-las-americas-2017/?p=67

https://www.un.org/sustainabledevelopment/

https://www.ted.com/talks/michael_green_the_global_goals_we_ve_made_progress_on_and_the_ones_we_haven_t

https://www.youtube.com/watch?v=a5xR4QB1ADw

https://www.ted.com/talks/jude_wood_building_a_resilient_community

https://www.who.int/initiatives/decade-of-healthy-ageing

https://www.jeffsachs.org/

Age-Friendly Checklist: Overview of Communication & Information[11]

Providing Information
• Assure a basic, universal communications system of written and broadcast media and telephone reaches every resident.

Oral Communication
• Make accessible for older people, e.g., through public meetings, community centers, clubs and the broadcast media, and through individuals responsible for spreading the word one-to-one.

Plain Language
• Print and spoken communication uses simple, familiar words in short, straightforward sentences.

Technology, Computers & the Internet
• There is wide public access to accessible technology, computers and the Internet, at no or minimal charge, in public places such as government offices, community centers and libraries.

A more comprehensive Age-Friendly Checklist for Communication & Information11 includes the following:

Providing Information
- Assure a basic, universal communications system of written and broadcast media and telephone reaches every resident.
- Distribute information regularly and reliably.
- Disseminate information to reach older people close to their homes and where they conduct their usual activities of daily life.
- Coordinate an accessible community site for a one-stop information center.

Oral Communication
- Make accessible for older people, e.g., through public meetings, community centers, clubs and the broadcast media, and through individuals responsible for spreading the word one-to-one.
- People at risk of social isolation get information from trusted individuals with whom they may interact, such as volunteer callers and visitors, home support workers, hairdressers, doormen or caretakers.
- Individuals in public offices and businesses provide friendly, person-to-person service on request.

Printed Information
- Printed information – including official forms, television captions and text on visual displays – has large lettering and the main ideas are shown by clear headings and bold-face type.

Plain Language
- Print and spoken communication uses simple, familiar words in short, straightforward sentences.

Automated Communication & Equipment
- Telephone answering services give instructions slowly and clearly and tell callers how to repeat the message at any time.
- Users have the choice of speaking to a real person or of leaving a message for someone to call back.
- Electronic equipment, such as mobile telephones, radios, televisions, and bank and ticket machines, has large buttons and big lettering.

Computers & the Internet
- There is wide public access to computers and the Internet, at no or minimal charge, in public places such as government offices, community centers and libraries.
- Tailored instructions and individual assistance for users are readily available.

Respect & Social Inclusion

There are substantial differences in assumptions about aging and attitudes towards older adults across cultures. In some places, older adults are respected and revered as elders, while in others they are marginalized and assumed to be unable to contribute to society. In communities where older adults do not feel respected or feel excluded from social life, it is unlikely they will participate.

Social inclusion can be achieved by assuring that older adults are not segregated from younger members of the community. Intergenerational living and programming can help facilitate interactions between generations and create an atmosphere of inclusion while fostering respect.

Age-friendly Checklist: Respect and Social Inclusion[11]

Respectful and inclusive services
• Older people are consulted by public, voluntary and commercial services on ways to serve them better.

Intergenerational and family interactions
• Community-wide settings, activities and events attract people of all ages by accommodating age-specific needs and preferences.

Public education
• Older people are provided opportunities to share their knowledge, history and expertise with other generations.

Community and Economic inclusion
• Older people are included as full partners in community decision-making affecting them.

A more comprehensive Age-Friendly Checklist for Respect and Social Inclusion11 includes the following:

Respectful and inclusive services
- Older people are consulted by public, voluntary and commercial services on ways to serve them better.
- Public and commercial services provide services and products adapted to older people's needs and preferences.
- Services have helpful and courteous staff trained to respond to older people.

Public images of ageing
- The media include older people in public imagery, depicting them positively and without stereotypes.

Intergenerational and family interactions
- Community-wide settings, activities and events attract people of all ages by accommodating age-specific needs and preferences.
- Older people are specifically included in community activities for "families".
- Activities that bring generations together for mutual enjoyment and enrichment are regularly held.

Public education
- Learning about ageing and older people is included in primary and secondary school curricula.
- Older people are actively and regularly involved in local school activities with children and teachers.
- Older people are provided opportunities to share their knowledge, history and expertise with other generations.

Community inclusion
- Older people are included as full partners in community decision-making affecting them.
- Older people are recognized by the community for their past as well as their present contributions.
- Community action to strengthen neighborhood ties and support include older residents as key informants, advisers, actors and beneficiaries.

Economic inclusion

• Economically disadvantaged older people enjoy access to public, voluntary and private services and events.

Implications for Rural Communities

While WHO's age-friendly guidelines were developed based on input from people living in cities, we believe the concepts apply in rural areas as well. Generally speaking, rural communities that plan and implement sustainable aging practices have better community health outcomes for all citizens.18,19 Key sustainability factors specific to rural communities have been identified. These include creating accessible physical environments (e.g., housing, transportation) and engaging social environments,19 in line with the WHO guidelines described above. The impact on community health and well-being from other important variables such as income, education levels, and race varies from community to community. However, Zhang and colleagues argue that creating an inclusive and engaging social environment is a critical factor, the importance of which cannot be underestimated.19 Not only do older adults benefit from age-friendly communities they also benefit from the opportunity to be active and engaged participants in the process of planning and implementing sustainable aging initiatives. And, a community that works for older adults works for everyone.

In Western North Carolina, a number of efforts are underway to support people as they age in this largely rural region of Appalachia. We describe one broad example here to illustrate the connection to the WHO domains and checklists above and to suggest how to expand these opportunities throughout the region.

Although rural communities lag in healthcare infrastructure and services18 they frequently engage in innovative strategies and partnerships to deliver services to older adults. One example of this type of practice is the Aging Well collaborative that includes partnerships between the High Country Area Agency on Aging, which serves a 7-county region, the Institute for Health and Human Services at Appalachian State University, High Country Caregivers, and senior centers. This collaborative is developing a suite of services for older adults, including screening examinations for mental and physical health (e.g., falls, grip strength, nutritional status, loneliness and isolation) and programming to promote health and support caregivers of older adults. This effort builds upon existing networks and programs offered by local agencies and organizations and provides additional resources in terms of clinic space, faculty expertise, and student work to make the exams and programming possible. We are seeking to offer a range of services that are accessible and that incorporate intergenerational contact and support, linking students, faculty and staff, and community members.

Our hope is that as the more health-services focused aspects of this collaborative develop so too will the opportunities to engage in work that supports other domains of age-friendly communities. For example, we expect that discussions around respect and social inclusion will expand to formal training for students and the broader community and that, together with older adults, we may develop additional strategies to promote this inclusion through methods suggested in the WHO document, including in public images and media coverage and by working towards greater inclusion of economically disadvantaged or isolated older adults. Likewise, while the initial activities of the collaborative are focused specifically on health, we expect that as the network grows and we build trust with older adults across the community that we may be able to offer or support community events and activities that promote well-being but are not directly perceived as being related to health care or health services.

Rural communities looking to embrace the age-friendly framework to improve the health and well-being of their citizens should be aware that these efforts require leadership, planning, strategic partnerships and development of a supportive and sustainable infrastructure. The AARP Network of Age-Friendly States and Communities (https://www.aarp.org/livable-communities/network-age-friendly-communities/) is an excellent resource for communities. This resource provides a framework as well as many of the resources required to begin the process for being recognized as an age-friendly community. Additionally, the AARP offers challenge grants to community leaders and organizations in order to support age-friendly initiatives.

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Got nature? An interdisciplinary approach to promoting healthy outdoor play and exercise

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Residents of the Appalachian region are at greater risk for chronic illness and have a high rate of inactivity. Spending time in nature settings and being physically active have both shown positive impacts on physical and mental health. Health care providers are now encouraged to ask patients about their physical activity habits and are prescribing outdoor physical activity across the country and internationally. By exploring innovative strategies, collaborative teams are encouraging children and adults to be physically active in public outdoor spaces. The Appalachian State University interdisciplinary Healthy Outdoor Play and Exercise (HOPE) Lab's purpose is to investigate and promote the role of outdoor physical activity, exercise, and play on health, the environment, and human development. A focus of the HOPE Lab is to form sustainable partnerships to get more people active outdoors to improve health and well-being. This article discusses health benefits of time spent outdoors and the interdisciplinary work of the HOPE Lab to promote outdoor physical activity as well as present its partnerships and projects within the Appalachian community.

Introduction

In the unique rural setting of the Appalachian region, residents face numerous obstacles related to high poverty and geographic isolation. Additionally, while this region spans the Appalachian mountain range and includes 13 states that have a number of national, state and local parks, residents and communities face challenges including transportation, programming and financial support for recreational activities. In the Appalachian Region, the mortality rate 17 percent higher for heart disease at 204 per 100,000 population than compared to the national 175 per 100,000 population. This regional average actually conceals some areas that are much higher, such as in Central Appalachia, where the heart disease mortality rate is 42 percent higher than the national rate. The Appalachian region suffers from many chronic illnesses such as diabetes, cancer prevalence, chronic obstructive pulmonary disease, depression, and strokes at a higher rate than the nation. Risk factors for chronic disease include smoking, obesity, diabetes, excessive alcohol use, stress, and physical inactivity. Suicide rates are higher than the nation in all five Appalachian subregions and Central Appalachia reports an incidence 31 percent higher than the national rate.[1] Thus, the Appalachian region is a geographic setting in dire need of attention aimed at alleviating numerous factors related to health and wellbeing.

Spending time in outdoor settings and being physically active have both shown positive impacts on physical and mental health.[2–4] These health-related benefits include decreased symptoms of stress and depression as well as increased feelings of well-being and participation in moderate levels of physical activity.[5,6] Currently, the physical activity guidelines for adults includes 150-300 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity a week and participation in muscle-strengthening activity for at least two days a week. The guidelines for children and youth are to participate in at least 60 minutes of moderate to vigorous physical activity a day.[7] However, children and adults are not meeting the recommended guidelines for physical activity and on average, children spend four to seven minutes daily in the outdoors.[8,9] Specifically, in the

Appalachian region, physical inactivity ranges from 26.2 percent in Northern Appalachia to 33.8 percent in Central Appalachia, all of which are above the 23.1 percent reported for the United States as a whole.1 Access to outdoor spaces reduces the risk of obesity, and living in a neighborhood with more opportunities for physical activity has been associated with a lower risk of type 2 diabetes.[10] However, an important barrier to accessing public outdoor spaces is the lack of knowledge or awareness of these spaces.[11] As a result, determining ways to improve visitation to public outdoor spaces has significant health benefits.[2]

The Appalachian region, as defined by the Appalachian Regional Commission, comprises over 200,000 square miles across the Appalachian mountains from southern New York to northern Mississippi and has many outdoor areas. With the focus of this article being on outdoor physical activity, it is important to identify the terms often used to refer to the outdoors. Previous research used numerous terms such as green living environment[10], green space[12], nature[2,4,13], outdoors[14–17], outdoor natural environments[6], and parks[11] to describe locations for physical activity in an outdoor setting. For the purpose of this article these terms are described as public outdoor spaces. The term public outdoor space is selected because it encompasses all the natural elements in outdoors spaces found in both rural and urban settings.

In 2007, with an aim to improve physical activity participation, the Exercise Is Medicine (EIM) initiative was started by the American College of Sports Medicine and the American Medical Association with the intention to incorporate exercise as a vital sign at a visit with a health care provider. With this initiative health care providers are now encouraged to ask patients about their physical activity habits while also asking about their diet or other health behaviors. If necessary, the health care provider can prescribe exercise and refer the patient to see an exercise professional.[18] Since 2007, the EIM initiative has gained momentum and has introduced programs on a global perspective, on college campuses, and just recently, in pediatric clinics.[19] However, little has been done in regards to prescribing physical activity outdoors. The growing body of literature regarding the health-related benefits of being outside and being active outside is growing vastly, especially in European countries and Australia. Yet, the United States is lagging behind. Additionally, little has been done to effectively understand the impact of prescribing not just physical activity but physical activity outside.

Many disciplines are breaking down silos and forming sustainable partnerships to address how physical activity and outdoor exposure impact health. By exploring innovative outdoor physical activity strategies, like Park Prescription Programs (e.g., ParkRx), TRACK Trails, and Kids In Parks, collaborative teams are encouraging children and adults to be physically active in public outdoor spaces. Park and recreation agencies make their greatest contributions to health and well-being by providing and enhancing public outdoor spaces. Exercise scientists and physical educators encourage physical activity across the lifespan through innovative programming and instruction. Public health professionals are always at the forefront of health (e.g., smoking cessation and healthy eating), and they strive to help the public make the necessary connections to understand and appreciate the positive benefits of physical activity in outdoor settings. Healthcare providers, such as social work and nursing, provide holistic care by encouraging outdoor physical activity, helping to identify ways to make that activity possible, and by promoting overall physical and mental well-being. This interdisciplinary approach fosters programs and other projects promoting physical activity in local parks and building collaborations with health care providers (Parks and Recreation Departments, Public Health, Social Work, Health Clinics, Physical Education) to "prescribe" outdoor activities to patients. In fact, in 2013 the American Public Health Association (APHA)[2] discussed in a policy statement the importance of multiple disciplines working together to counsel patients and the public about the advantages of outdoor physical activity. To assist in access, APHA continues their statement encouraging other outdoor activities and the establishment of relationships with local parks and recreation departments, school districts, and nature centers.

In accordance with this policy statement, the Appalachian State University's Healthy Outdoor Play and Exercise (HOPE) Lab team established its own set of health professionals who focus on the importance of being physically active outdoors. Specifically, the purpose of the HOPE Lab is to investigate and promote the role of outdoor physical activity, exercise, and play on health, the environment, and human development. The HOPE Lab's vision is to increase the wellbeing of people as well as foster stewardship

of the natural environment by getting more people outdoors. This article discusses the health benefits of time spent outdoors, current strategies to promote physical activity, and the interdisciplinary work of the HOPE Lab to promote outdoor physical activity, as well as present its partnerships within the Appalachian community.

Benefits of Outdoor Activity

The physical and psychological health benefits of physical activity are well supported in the multi-disciplinary literature; however, a number of studies over the past several decades have given special attention to the role of the physical activity environment (indoor or outdoor) in determining health outcomes, such as a reduction in body weight and chronic illnesses.[20] Access to public outdoor spaces suggest a positive association with increased physical activity, lower obesity rates, and lifelong healthy behaviors.[21–23]

Several reviews[5,6] suggest outdoor physical activity may be more supportive of psychological well-being than physical activity performed indoors. For example, outdoor physical activity was more likely to reduce tension, anger, and depression, and increase energy and engagement.[6] Additionally, Puett and colleagues[5] found that adults who exercised outdoors were more active overall and when compared to those who were only active indoors; participants that completed part of the physical activity outside experienced a stronger protective effect against: poor emotional outlook, poor overall health perception, stress, and tension.

Outdoor physical activity has been associated with improvements in executive-based attention, restoring depleted attentional resources in comparison to activity completed in urban environments. It can restore directed attention and support both executive functioning and self-regulation processes in cognition, as well.[13,16,24,25] Berto[13] suggests this is because outdoor exposure reduces one's overall stress both physically and mentally. Hug and colleagues[24] concur, noting that outdoor physical activity reduces the impact of everyday hassles and restores feelings of mental balance.

Recent evaluations of programs designed to leverage the restorative qualities of outdoor physical activity have demonstrated significant improvements in psychological well-being, self-efficacy, and stresses related to daily demands.[15] Zurawik[26] found that participants experienced strong psychological and social benefits, such as overall individual well-being, improved social interactions, and emotional bonding between people and spaces, when leisurely walking outdoors. The benefits of planning for public outdoor spaces in urban, and more recently suburban and rural, neighborhoods are lower levels of depression, anxiety, and stress.[5,12,13] Adults in this research who had low exposure to outdoor environments as children were significantly more likely to have a variety of mental health symptoms than those with high outdoor exposure. Respondents with low outdoor exposure in childhood were also less likely to see the importance of outdoor exposure.[27] Thus, the HOPE Lab's model of interdisciplinary collaboration supports the need for outdoor physical activity to reduce chronic illnesses such as obesity, mental illness, and to improve individual wellness.

Ecological Models of Health Behavior

The ecological model[28,29] describes the "joint function of the characteristics of the environment and of the person" in determining developmental processes and outcomes (p. 115).[29] The application of this model in practice and research is the person-in-environment perspective that is built on the understanding that behavior, development, coping, risk, and resilience are all driven by the interaction between personal and environmental characteristics. Ecological systems theory outlines several nested systems or spheres of influence, including the intrapersonal, interpersonal, institutional, community, and societal or macrosystem, that delineate the complex pathways through which individuals interact with their environment.[30] A key component of ecological models is reciprocal determinism: a person's behaviors are influenced by the environment in which they live as well as their behaviors influence these environments.[31]

The intrapersonal level is made up of biological, psychological and cognitive aspects of individual people that influence their behavior. Examples include pre-existing health conditions such as heart conditions, asthma, obesity, allergies, and symptoms of depression, as well as their personal likes and dislikes, beliefs, attitudes, motivations, etc. to engage in behaviors. The next sphere of influence, the interpersonal level, consists of interactions with

those closest in proximity, including the family, pets, school, neighborhood, and peer groups, etc. The institutional level comprises the organizations that people regularly come into contact with including workplaces, schools, faith-based organizations, social services, fitness/wellness centers, local park and recreation departments, and health care facilities.

The community is the next sphere defined by geographic and shared cultural factors and the interrelationships that exist among institutions and organizations. Some examples may include the distinct social and physical environments of the towns and cities within the counties of the Appalachian region. The societal level or macrosystem is the broadest layer and consists of the larger cultural, public policy, and media environments in which people live. This sphere includes, for instance, the national and state public policies, societal cultural norms, expectations, and collective attitudes of the general public that influence organizations within communities and thus individual and family health behaviors. These larger social concerns have a strong effect, although not always directly, on a person in their environment.[29] Issues related to low socio-economic status, poverty, institutionalized racism, and climate change would be examples of influences at this level.

Whether influences at each level are helpful to individual development and functioning or detrimental depends upon the complex interactions between human beings and their environments. People are not all affected in the same way by stressors in their intrapersonal, interpersonal, institutional, community, and societal spheres of influence. To comprehend the complexities of human behavior, a framework is needed that accounts for influences throughout the social ecology.

Interdisciplinary Approach

In the Ecological Model of Health Behavior, there are many professions that can be spheres of influence on human behavior at all levels. Working from an interdisciplinary perspective, the HOPE Lab identifies strengths, barriers, and interventions related to physical activity in the individual, family, school system, neighborhood and community, local and national economy, and local and national policies using the Bronfenbrenner model. The HOPE Lab consists of the following disciplines: Recreation, Public Health, Nursing, Social Work, Physical Education, and Exercise Science. Faculty, staff, students and community partners are working together to encourage healthy outdoor physical activity. The HOPE Lab and its partners collaborate to creatively prescribe outdoor physical activity and encourage healthy lifestyles.

Each of the fields described (Recreation, Public Health, Nursing, Social Work, Physical Education, and Exercise Science) are spheres of influence on the health and wellbeing of people. In fact, each discipline utilizes the theoretical framework of Bronfenbrenner's Ecological model[28] to better understand influences on, within and around people. In the past, the focus of a discipline's scholarship was on issues specific within the discipline itself. Oftentimes we would borrow from other disciplines to help us understand our world view and the behaviors of the people we serve, but the focus was usually within our own discipline's lens and with our perspective in mind. However, this singular focus within the discipline can be isolating and not as impactful on influencing people's behavior throughout their lifespan. Using the Ecological model as a way to view the spheres of influence such as the intrapersonal, interpersonal, institutional, community, and societal or macrosystem, one can see that interdisciplinary research and developing collaborations across professions might be more impactful.

HOPE Lab Origins

The HOPE Lab was created to bring an interdisciplinary approach to research and provide best practices for practitioners to promote health across the lifespan through spending time in the outdoors. Interdisciplinary research is key to generating strategies to solve challenges facing society.[33] The interdisciplinary approach of the HOPE lab began with Exercise Science and Recreation Management.

The HOPE Lab had its origins in 2010 with researchers from Exercise Science and Recreation sharing a common interest in promoting outdoor physical activity. The researchers created a research initiative called the Outdoor Research Cluster to investigate the topic of "outdoor play and its relationship to health and wellness, the environment, and human development" with support provided by the university's Humanities Council. During this three-year project, scholars from many different disciplines (psychology, marketing, student affairs, theater, government studies, recreation, exercise science, and health

promotion) participated in reviewing the literature and conducting research. The group recognized that, in addition to research, they needed to look at ways to get information out to the community. In the third year, the Outdoor Research Cluster created an event within the community called Unplug Yosef and Get Outside. This event encouraged the Appalachian community to unplug from technology on one day for a minimum of four hours. During this time, volunteers provided passive and active programs at numerous public outdoor spaces. The initial activities of the Outdoor Research Cluster and application of its findings in both research and public programming laid the foundation for the interdisciplinary work of the HOPE Lab.

In 2014, Dr. Christiana, a public health scholar, who was also interested in increasing outdoor physical activity, joined Drs. Battista (Exercise Science) and James (Recreation). Building on work from the Outdoor Research Cluster, discussions began regarding ways to encourage outdoor physical activity within the rural mountain community. Understanding health care providers are often seen as a knowledgeable source when it comes to health-related topics, ideas on ways to engage them with their patients and discussing ways to increase physical activity became a focus for the HOPE lab. One national-level interdisciplinary initiative considered for implementation in the community was the Park Prescription program, which includes collaboration with healthcare providers. At that time, there was limited research on park and outdoor activity prescription programs, specifically within rural regions. The interdisciplinary partnership began writing grants and conducting seminal research on prescription programs for children in rural areas.[14,34] Additionally, the team began sharing insights and language from the different disciplines leading to the development of a common language used to define the problem from multiple angles. This, in turn, led to seeking out other stakeholders to develop both a more cohesive team and research projects. Other scholars, such as faculty of environmental science and policy at the College of William and Mary, who had created the Park Champion Prescription program for campus, and organizations, such as Park Rx American and The Institute at the Golden Gate, were soon brought into the conversation. By the fall of 2016, the team officially formed the HOPE Lab to facilitate a more formalized collaboration within the university, as well as with stakeholders nationwide.

The mission of the HOPE lab is to investigate the role of outdoor physical activity, exercise, and play on health, the environment, and human development. The vision of the HOPE Lab is to continue developing the scientific foundation for promoting and supporting outdoor physical activity, exercise, and play through interdisciplinary research. Recognizing the importance of multiple perspectives, Dr. Brooke Towner, a Physical Education scholar, joined the team in 2018. Until she joined, the HOPE Lab focus had been in out-of-school experiences and now has been able to broaden its reach into school-related experiences and include both structured and unstructured outdoor play. Other HOPE Lab team members include undergraduate and graduate students in a variety of disciplines who assist in research projects, as well as conduct their own mentored Honors and Master's Theses projects.

Informed by our experiences, the HOPE Lab has sought to broaden its scope to be more impactful, to work with individuals across the lifespan, and to focus on mental, as well as physical, health. Through university, community, regional and national presentations, we are sharing our work, bringing in new partners including Dr. Robert Broce--Social Work, and Dr. Heather Venrick--Nurse Practitioner, and building collaborations that can help us address the issue of physical and mental health through physical activity in public outdoor spaces.

HOPE Lab Sustainable Partnerships

The HOPE Lab interdisciplinary approach is the foundation for conducting research that is applicable and meaningful to society. With its approach to developing partnerships for Appalachia and rural prescription programs, the HOPE lab has distinguished itself as a resource nationwide.

With the growing movement towards health care providers prescribing public outdoor spaces outdoors to patients to improve health, the HOPE Lab has focused on partnering with health care providers to investigate this prescription approach. Currently, outdoor and park prescription programs have not been well researched in terms of implementation strategies and effectiveness in changing behavior. During 2015-2016, The HOPE Lab conducted a pilot study of pediatrician-written prescriptions and counseling intervention for outdoor physical

activity[34] and a qualitative study to understand the perspectives and insights of children's health care providers on prescribing nature and outdoor activity.[14] These studies were some of the first to be conducted in this area and provided valuable insight to implementing park and outdoor physical activity prescription programs. The results of the qualitative study of health care provider perspectives led to a collaboration with Kansas State University to create a survey to be distributed to health care providers to assess their current physical activity counseling practices and interest in outdoor and park prescriptions (study results currently in review for publication). The pilot study was conducted with the sole pediatric office in Watauga County. Half of the physicians wrote prescriptions for their patients and discussed the importance of outdoor physical activity for children with patients and parents while half of the physicians acted as a control group.

One of the most important aspects learned from these initial studies with HOPE Lab collaborators was the need to provide health care providers with targeted resources. One of these resources was an online database of local public outdoor spaces that health care providers could use both when talking to patients and parents as well as for patients and parents to use at home to locate places for outdoor physical activity. This led to a collaboration with the Washington DC based Park Rx America (www.parkrxamerica.org), "a non-profit whose mission is to decrease the burden of chronic disease, increase health and happiness, and foster environmental stewardship, by virtue of prescribing Nature during the routine delivery of healthcare by a diverse group of health care professionals" (https://parkrxamerica.org/about.php). The result of the Park Rx America partnership was the design and creation of a website where health care providers and patients in the High Country Region could search for places for outdoor physical activity close to where they live and know the amenities and facilities available at each location (www.parkrxamerica.org/highcountrync). With funding from the Appalachian State University Chancellor's Innovation Scholars grant, the HOPE Lab assessed public outdoor spaces to put into the first rural Park Rx database for western North Carolina., which is now available for use. This database allows health care providers to provide resources to their patients on where to go locally to engage in outdoor physical activity. Evidenced by earlier research, we learned resources were a critical component for health care providers.

Several of the HOPE Lab's ongoing research projects are in collaboration with an outdoor physical activity resource, Kids in Parks (www.kidsinparks.com). Kids in Parks "offers an expanding network of family-friendly outdoor adventures called TRACK Trails." TRACK Trails consists of self-guided brochures and signs along existing trails that create a fun and exciting experience for children. Kids in Parks is funded through the Blue Cross Blue Shield North Carolina Foundation and has been widely praised and awarded by numerous organizations across the country for its innovation. The HOPE Lab is working with Kids in Parks to evaluate a new system of TRACK Trails to be installed throughout South Carolina with funding from the Blue Cross Blue Shield of South Carolina Foundation. This will consist of assessing whether the installed TRACK Trail enhancements are effective in increasing the number of trail users, time on the trail, and physical activity levels.

Another ongoing collaborative research project with Kids in Parks is to evaluate the TRACK Trail prescription program. This program consists of a network of children's health care providers in areas with TRACK Trails that prescribe the trails and other outdoor activities to patients. Patients can log their activities online through the Kids in Parks website to receive prizes in the mail while providers can track their progress and send reminders. With funding from the Appalachian State University Research Council, the HOPE Lab is designing a survey to be conducted with patients and parents to assess how the prescription and website tracking system has improved their physical activity levels and mental health. Additionally, the HOPE Lab is seeking further external funding to support a full-scale evaluation of the TRACK Trails program.

Additionally, HOPE Lab researchers work with local health care providers, parks and recreation agencies, schools and the University to conduct studies and plan future research. College is a time where young adults begin to develop long lasting behaviors. This is also a time when physical activity levels are low and when mental health is impacted. Knowing the physical and mental health benefits of being active outside, the HOPE Lab developed an Outdoor Prescription Program utilizing a peer to peer mentoring network where college students provided park prescriptions to peers. Upperclassmen were

recruited and trained to become Student Outdoor Champions (SOC), and were asked to meet with participants, promote outdoor physical activity, and provide a park prescription utilizing the database created with Park Rx America. SOC provided follow up messages with students to encourage participation in their prescribed parks. While the project was designed to determine if this sort of program was feasible, some improvements in physical activity occurred. From a more long-term perspective with guidance from the HOPE Lab, a new student organization was established to provide these opportunities to other students.

Programs that promote outdoor physical activity can be especially beneficial for persons with intellectual disabilities because of increased risk for chronic diseases and lack of access to opportunities for exercise. A James Diversity Grant was received to increase access by targeting an SOC to students in the Scholars with Diverse Abilities Program (SDAP). SDAP provides students with mild to moderate intellectual disabilities access to a 2-year inclusive college educational experience. This project investigates if SDAP participants will independently engage in outdoor physical activities after the SOC referral. Participants will receive a specific parks referral with follow up from a trained outdoor champion, participate in a series of field trips, track their activity levels, and end with a celebration.

As a result of the partnership with Kids in Parks, an opportunity to conduct research with the Appalachian State University (ASU) Homeschool Physical Education Program presented itself. The project will utilize the Kids in Parks website and incentive program as a physical activity option outside of the ASU Homeschool Physical Education Program. This project will study physical activity and mental health in response to participating in an outdoor physical activity incentive program.

A future research project presented itself with a team of first grade teachers and a physical educator at a K-8 school in North Carolina. Recognizing the importance of physical activity during the school and taking advantage of the outdoors, first grade teachers integrated physical activity components into their science units. This project will examine physical activity during physical education lessons and science lessons with physical activity components in outdoor spaces.

Conclusion

Continuing to work within the Appalachian community to investigate the role of outdoor physical activity on health, the environment, and human development will remain at the center of the HOPE Lab's purpose. In alignment with The HOPE Lab's purpose, the team has conducted research projects with experts across the country, presented as experts on prescription programs and authored professional and peer-reviewed publications. Focusing on evidence to guide the next steps is critical to the continuation of any program. As the trend continues to move toward holistic system level approaches, involving a variety of disciplines, engaging key stakeholders, and sustainable partnerships will provide the HOPE Lab continued success.

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Climate, Environment, and Public Health in Western North Carolina

Maggie Sugg, Lauren Andersen, Elizabeth Shay, Jennifer Schroeder Tyson, and Jennifer Runkle

The frequency and severity of extreme weather events are expected to increase in the context of a changing climate. Populations across the globe are vulnerable and already experiencing the health effects of a changing climate. Western North Carolina (WNC) is no exception. The last decade was the warmest ever on record. This past year, 2019, broke historical records in North Carolina, and temperature anomalies in WNC largely drove this pattern. The indirect and direct effects of climate on human health are complicated and modulated by underlying social vulnerabilities that enhance the severity and sensitivity of population exposure to climate hazards. In this paper, we discuss the complex pathways through which climate hazards impact health in WNC and the on-going efforts among the academic and public health community to address these emerging climate-related health threats. Specifically, we highlight the changing patterns in (1) temperature-related disease, (2) vector-borne disease, (3) natural hazards, (4) mental health impacts and the (5) built environment. Lastly, we identify important research needs and partnerships required to motivate effective and meaningful engagement with the public and policymakers around the regional impacts of climate change on human health, potential solutions, and co-benefits of resilience planning in WNC.

Introduction

The influences of extreme weather and climatic events are significant and varied, with both indirect and direct public health impacts. Climate change is projected to change the frequency, severity, duration, and locations of these extreme events, thereby placing populations at risk for new or elevated exposure to climate stressors such as higher temperatures, heavy rainfalls and floods, and droughts[1]. In North Carolina, average summer temperatures have been the warmest on record over the last 14 years, and the number of very warm nights is increasing at a higher rate than warm days[2]. Projections suggest that North Carolinians will experience historically unprecedented warming by the end of the 21st century, increasing the intensity of heatwaves. Although there is no clear signal for precipitation, projections highlight significant increases in annual perception with the potential for precipitation to be concentrated in heavier rainfall events with more prolonged periods of drought.

Climatic events act as a threat multiplier by which existing health conditions and underlying social stressors (such as unemployment, stigmatization, poverty) work in combination with environmental stressors, such as urbanization, air pollution, and loss of urban tree canopy, to increase a population's vulnerability to climate exposures. Other subpopulations who are generally vulnerable to a wide range of health insults are also most at risk for climatic changes; these include the young, the elderly, and pregnant women[1].

In this paper, we discuss the complex pathways through which climate hazards impact health in WNC and the on-going efforts among the academic and public health community to address these emerging climate-related health threats. Specifically, we highlight the changing patterns in (1) temperature-related disease (2) vector-borne disease, (3) natural hazards, (4) mental health impacts, and the (5) built environment. Lastly, we identify important research needs and partnerships required to motivate effective and meaningful engagement with the public and policymakers around the regional impacts of climate change on human health, potential solutions, and co-benefits of resilience planning in WNC.

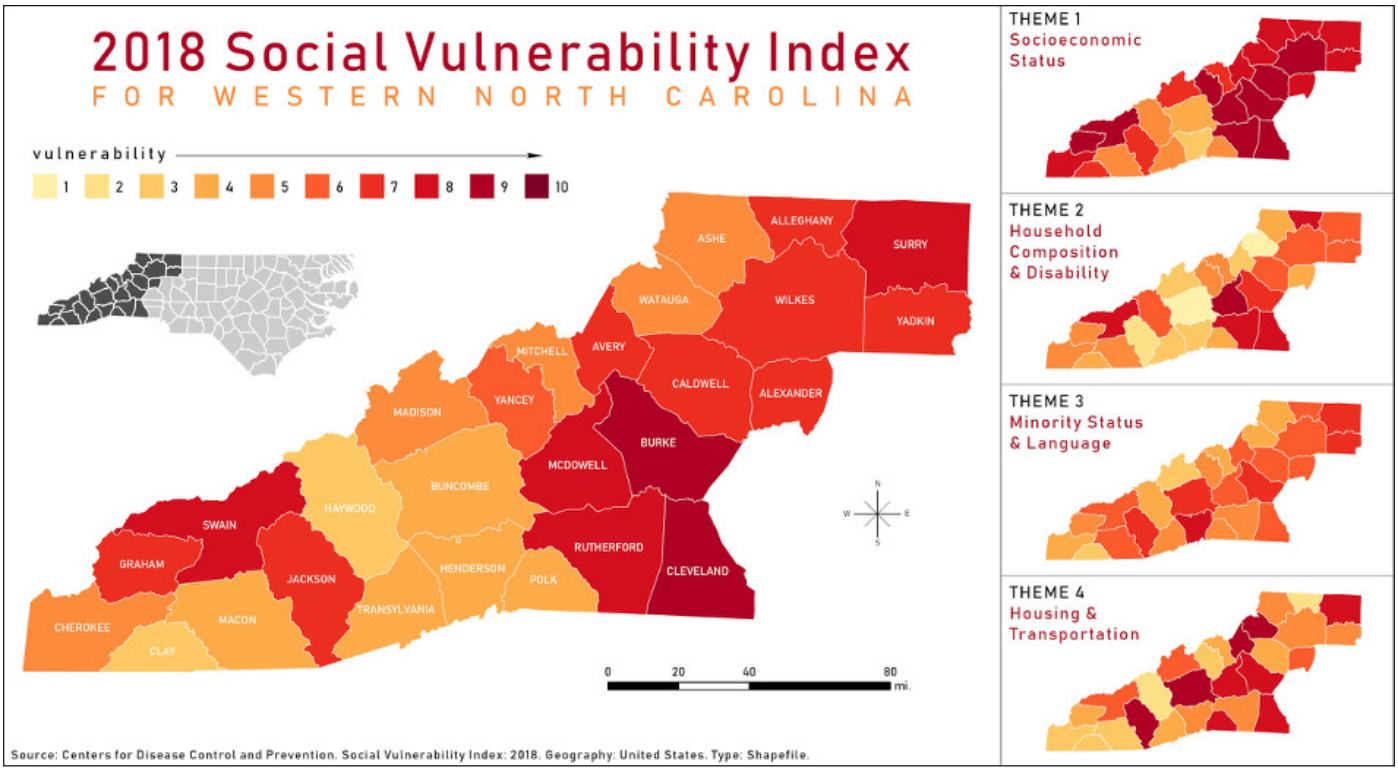

Figure 1. The 2018 social vulnerability index for WNC, USA.

The WNC region encompasses 27 counties in NC[4]. The region is an important source of water for major cities like Charlotte and Atlanta and a popular destination for outdoor recreation, including camping, hiking, biking, and winter sports, due to the landscape and presence of federal areas, such as the Blue Ridge Parkway and Great Smoky Mountains National Park. The region is divided by the Blue Ridge Escarpment into two physiographic provinces—the Blue Ridge and the Piedmont. The Blue Ridge Escarpment and associated elevation gradient drive temperature and precipitation variability throughout WNC. For example, precipitation ranges from less than 40 inches annually in Buncombe County to more than 100 inches in neighboring Transylvania County[5]. Variability in the physical landscape across WNC contributes to complex and frequently unpredictable weather patterns across the region.

According to the 2010 Census, 60.8% of the population in WNC is classified as rural, which is above the state (35.6%) and national (21.0%) values[6]. The large rural population is characterized by health challenges, such as lower life expectancy and higher rates of chronic disease and mental illness, driven in part by a lack of access to quality healthcare[7]. These health challenges are further exacerbated by economic hardship in many communities across the region. The poverty rate for the region is 16.9% with values as high as 27.2% in Watauga County, 13% higher than the rate for the United States8. Similarly, WNC's overall median household income in 2018 ($42,710) is below the state ($52,413) and national ($60,293) averages. Within the region, inequality is pronounced, with a difference of over $16,000 between the highest ($52,815 in Henderson County) and lowest ($36,525 in Graham County) median incomes[9].

As a result of economic disparities, there is great variation across WNC in the Social Determinants of Health (SDOH)—conditions in the social environment in which people are born, live, learn, work, and play that affect a wide range of health, functioning, and quality-of-life outcomes and risks[7]. The metropolitan locales, such as Asheville in Buncombe County, have greater access to goods and services and therefore greater capacity for resilience. In contrast, smaller communities must adapt with fewer resources. A variety of indices have been developed to measure the relative vulnerability of communities for the purpose of improving emergency response. The Center for Disease Control and Prevention's Social Vulnerability Index (SVI) ranks counties nationwide based on four themes: 1) socioeconomic status, 2)

household composition and disability, 3) minority status and language, and 4) housing type and transportation. Across WNC, SVI values are high, especially in the northern and eastern portions of the region (CDC 2018) (Figure 1). While the higher values are predominantly driven by socioeconomic variables, themes 2 and 4 also influence vulnerability in many counties. The varying drivers of vulnerability across the region highlight the need for local-scale responses.

TEMPERATURE-RELATED IMPACTS

Heat is the number-one weather-related killer in the United States[10]. In NC, heat-related illnesses, like heat syncope, heat exhaustion and in the most severe cases heat stroke, are responsible for at least 2000 emergency department visits per year[11]. Heat-related illness (HRI) in NC has a distinct pattern, with the most rural locations experiencing the highest heat-related illness rates, and urban locations experiencing the lowest rates of heat-related illness[12]. The patterns of HRI in NC contrasts with much of the literature that demonstrates urban locations due to their higher population and hotter temperatures (urban heat island effect) typically exhibit greater HRI risk. Although HRI in the mountains of WNC are low compared to other regions of the state, HRIs peak at lower temperatures well-below National Warning Service heat advisory and heat warning thresholds. Heat can also trigger other health outcomes, with significant increases in NC emergency department visits for conditions like cardiovascular and cerebrovascular diseases, and respiratory diseases (e.g., hemorrhagic stroke, hypotension, aneurysm, COPD, bronchitis, emphysema) [13].

In the mountains of NC, occupationally exposed grounds workers may perceive themselves at higher risk for heat strain; however, the overall risk is still low compared to other populations in the southeastern United States[14]. Nonetheless, they do experience physiological heat strain events, despite workplace adaptive measures in the summer including shifting the work schedule to the early morning hours and access to air-conditioned vehicles and buildings. A partnership between academics, students, and grounds workers have sought to enhance understanding around this issue by providing workers with personalized monitors and information on individual-level temperature exposure, heart rate and geo-locational changes to decrease occupational exposure to extreme heat[14-18].

Unlike other regions in the southeastern US, western North Carolinians are vulnerable to cold extremes, as well. Health impacts from cold temperatures can also occur at climatologically normal cool conditions whereby elevates health risks may occur in response to prolonged exposure[19]. Research has found that populations in the southeast US are more vulnerable to cold temperature due to adaptive measures and poor acclimation. Preliminary mapping has identified significant clustering of hypothermia in the far western part of the NC among adolescent males and the elderly[20]. Further research is needed to understand the underlying vulnerabilities and exposure risk for WNC populations to cold extremes.

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Vector-Borne Diseases

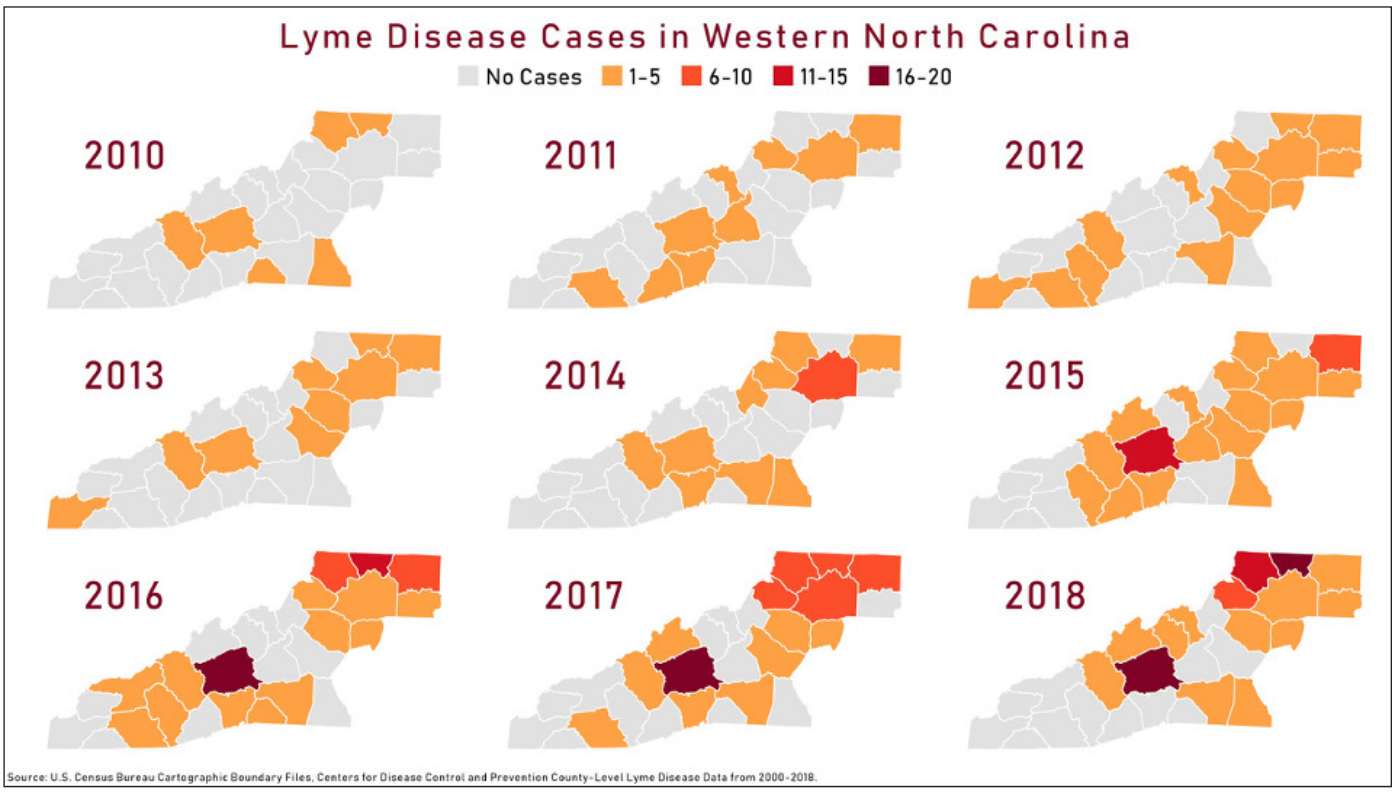

Figure 2. The 2010-8 Lyme disease cases in WNC.

Climate exerts a more indirect effect on vector-borne disease on WNC, with temperature and precipitation affecting the life cycle of vectors and the behavior of the human population. In NC, the most common vector-borne disease are associated with ticks, which carry diseases including Rocky Mountain Spotted Fever, ehrlichiosis, Lyme disease, and Southern Tick-Associated Rash Illness (STARI), although mosquito-borne diseases also occur, with less frequency (e.g., La Crosse Encephalitis, West Nile Virus, Eastern Equine Encephalitis) [21].

Previous investigations have reported the marked southward propagation of Lyme Disease from 2000 to 2014, southwest along the Appalachian Mountains with new disease clusters in the southern Virginia mountain region and expansion into WNC (Figure 2)[22]. AppHealth Care's State of the Community's Health Reports highlight Lyme Disease as an emerging issue for the area[23].

The main vector for Lyme Disease, Ixodes scapularis (commonly referred to as the deer tick or black-legged tick) is highly dependent on climate patterns, specifically in regard to temperature and water stress. Optimal climate conditions are crucial for I. scapularis to regulate off-host mortality. The distribution of I. scapularis has been forecasted to shift from the southern United States to the central United States in the future due to increasing temperatures[24]. Ticks are likely to thrive with increasing temperatures because of their long development in surface layers of the soil[25]. Lyme Disease is a zoonotic disease, spread between animals and humans, and is crucially connected to environmental factors[26]. As a result, the recent emergence of LD in North America has been shown to be linked to environmental change[24]. The most common host of I. scapularis is the white-footed mouse (Peromyscus leucopus), but other transmitters, such as deer, rodents, and even acorns, have also been identified[27-28]. The white-footed mouse is expanding northward due to milder winters[27,29]. Milder winters and earlier spring snowmelt could be driving white-footed mouse presence earlier in the year, indicating an increasing temporal range suitable for Lyme Disease[27]. New and existing vector-borne diseases remain an important contributor to morbidity among NC residents and more research is needed to understand which vectors and geographic locations within the state will be most impacted by future climate stressors[30].

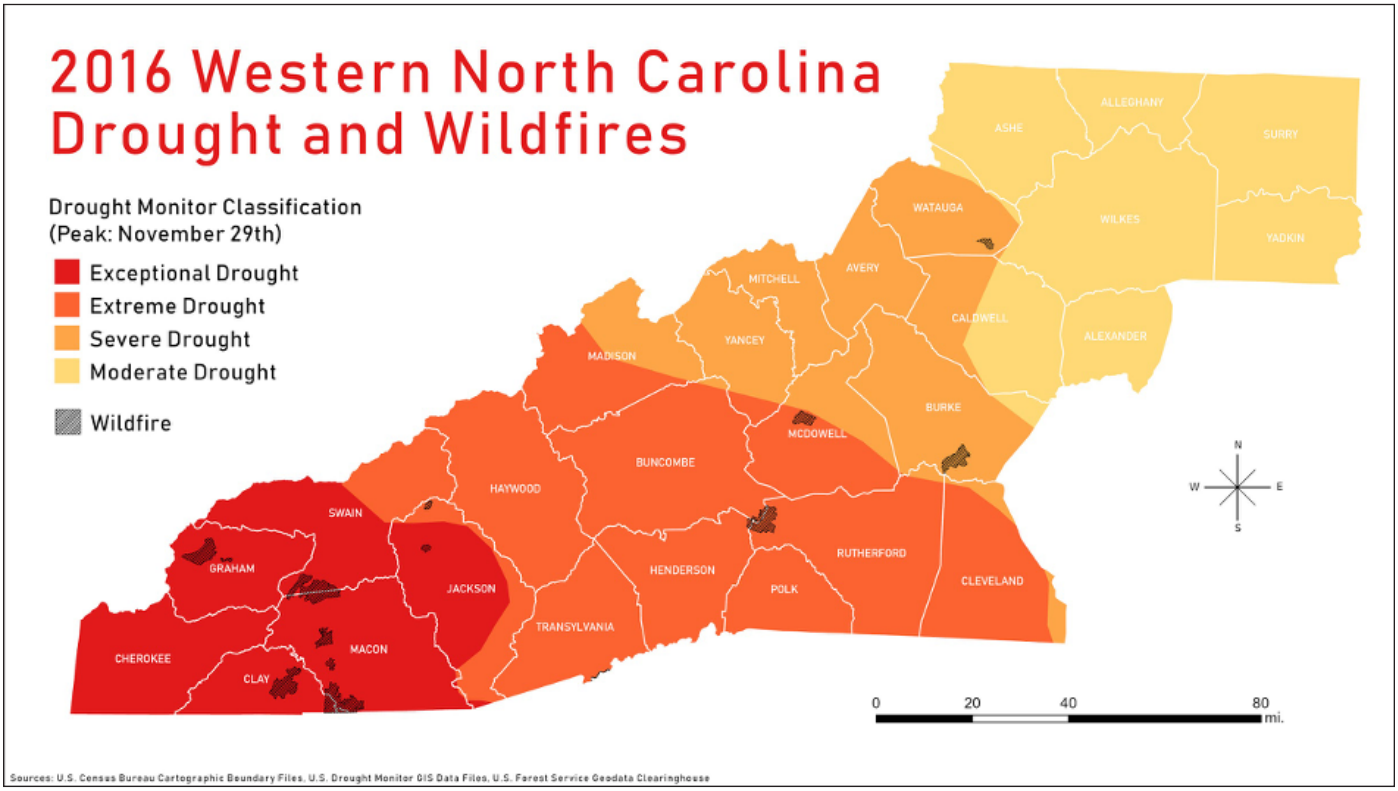

Figure 3. The 2016 drought and wildfires in WNC.

The WNC region is regularly impacted by extreme weather events like flooding, landslides, drought, and wildfire. In the future, climate changes may amplify these extreme events, increasing the frequency and/or intensity of droughts and floods and the potential for natural hazards like wildfires and landslides.

In 2004, tropical cyclones Ivan and Frances hit the region, resulting in the largest 24-hour rainfall in United States history to occur in WNC (near Grandfather Mountain with a measurement of 22 inches in 24 hours). Heavy rainfall events not only result in damage and injuries from flash flooding, but can also amplify the risk for landslides, a significant hazard in mountainous regions. Moreover, a combination of thin soils, steep slopes, and frequent precipitation increase the susceptibility of WNC to landslide events[31-32]. In 2004, the precipitation from Ivan and Frances resulted in approximately 400 landslide events across WNC that resulted in $200,000,000 in damage and the deaths of 11 individuals[33]. These events are not unusual to WNC, with heavy rains and subsequent landslides reported during earlier storms in 1916, 1940, and 1977 [31].

In 2016, WNC experienced an intense drought that began in March and worsened through late November, with all counties in the region experiencing moderate, severe, extreme or exceptional drought conditions[34]. From October through December, numerous wildfires occurred throughout WNC, burning approximately 60,000 acres (Figure 3) [35]. The wildfire outbreak was supported by a combination of ideal physical characteristics favorable to wildfire growth, accumulating fuel loads resulting from historical fire suppression practices, and extremely dry conditions caused by a severe drought. The wildfires were unprecedented for Appalachia, resembling wildfires occurring in California. The impacts of the drought and subsequent wildfires were far-reaching. During the wildfires, outdoor recreational activities - a significant source of revenue for WNC - ceased due to health concerns about the diminished air quality[36]. As precipitation becomes increasingly variable in the future, the risk of lengthy periods of drought and subsequent wildfire outbreaks, such as the one in 2016, also increases.

MENTAL HEALTH IMPACTS

Suicide is an ongoing public health crisis, with rates

increasing nearly 13% in NC from 1999 to 2016[3]. Most troubling, the incidence of suicide among adolescents is also increasing, with suicide as the second leading cause of death and nearly doubling over the previous decade[37]. The WNC region has an elevated risk of mental health impacts, particularly among adolescents, with spatially significant clustering of suicide in all WNC counties from 1999 to 2017 [38]. Elevated risk for suicide among rural populations in the U.S. is well-established. Suicide rates in most rural settings are nearly double those found in urban locations, and this gap is widening among adolescents[39]. Several possible explanations for this have been proposed, including limited availability of mental health services in rural regions, low acceptability of professional help-seeking (e.g., stigma), social isolation, socioeconomic factors, and access to lethal means[39].

The impacts of climate and natural hazards from mental health are unclear. Previous work by the authors has noted a strong relationship between temperature and crisis events, or events in which adolescents seek out the support of a crisis counselor in other areas of the country such as Chicago, IL and New York City, NY[40]. Preliminary results among the co-authors have also found a significant relationship with high temperature and emergency department visits from mental health conditions in WNC. Similar trends have been noted worldwide with elevated temperature being associated with increases in emergency room visits and/or hospitalizations for mental health illness in numerous countries including Australia, China, Canada, and Taiwan[41-45].

Research demonstrating physiological pathways for the association between temperature and mental health is evolving. One possible mechanism is an overactive temperature-response in the brown adipose tissue, which impairs heat tolerance and results in an intensification of anxiety, suicidal ideations and/or suicidal occurrence[46-47]. While brown adipose tissue is found in all humans, this mechanism might be particularly relevant to adolescents who have higher volumes of this tissue compared to adults[48]. High temperatures may also result in higher rates of hospitalizations among individuals who frequently use mental-health-related drugs, such as psychotropics[49]. Further research efforts are needed to understand the pathway between temperature and mental health conditions.

Although research is lacking in WNC, there is a strong relationship between mental health and natural hazards. In Eastern NC, a significant increase in crisis response, particularly for conditions like stress and anxiety and suicidal thoughts, were observed following Hurricane Florence, a tropical cyclone that devastated the eastern NC coast with heavy precipitation in 2018 50. Similar hurricane-related impacts have been felt in WNC resulting in multi-million-dollar disasters from the 2004 hurricanes (Ivan and Frances) and Hugo (1989), and these extreme events could be more intense under a warmer climate regime[1].

BUILT ENVIRONMENT

Decades of research into the relationship between transportation infrastructure and mobility has shown that individual and household travel choices (including number of trips, origins and destinations of trips, routes, and travel mode choice) respond to transportation infrastructure capacity and quality, as well as to the cost (in time and money), convenience, safety, and comfort of transportation services[51-52]. The reverse relationship—the environment shaping the built environment—also is observed, in terms of impact of both recurrent and extreme weather events (flooding, landslides, drought, wildfire, ice storms, hurricanes, and more) on the built environment, and increasingly onerous costs to maintaining and sometimes rebuilding transportation infrastructure in an era of heat (buckling pavement), flooding (erosion, scouring, building damage, human injury and death), sea level rise (loss of property, buildings, roads, and natural landscape), and other events that are increasingly frequent and severe with a changing climate[53].

Beyond transportation infrastructure, other features of the built environment are threatened by climate change, and offer rich targets for policy and technological innovation that prepare for the climate of the future. Harlan and Ruddell summarize a range of environmental strategies with the potential to address climate impacts, ranging from land uses (including urban gardens and forests, and water management tools) and transportation (supporting public transportation and non-motorized modes—walking and cycling), to more energy-efficient and climate-ready building materials and design, to effective communications (public messaging) and innovation in operations and systems[54]. The transition

to sustainable infrastructure needed to assure that society will both survive and thrive will require attention to the complexity of urban ecosystems and substantive shifts in planning and decision-making[55]. The intertwining of built and natural environment not only presents challenges (in studying, measuring, and addressing problems relating to climate stressors), but also offers the potential of co-benefits when acting on one identified component with attendant impacts on others. Indeed, Younger et al. argue that the human and environmental health impacts of transportation, buildings, and land use, including forestry and agriculture, can be tackled in ways that produce better outcomes across sectors and address sociodemographic inequities, such as those relating to access to mobility services and active travel modes, and the distribution of risks and benefits of pollution, green space, healthy and resource-efficient buildings[56].

The built/natural environment relationship manifests differently across landscapes. Rural regions are characterized by a variety of engineered landscapes, ranging from low-density scattered habitations and small-scale economic activity, to small towns with varying degrees of compactness and intensity of land uses, to cities in otherwise rural counties. In general, rural populations have a higher share of residents who are older, sicker, and poorer[57-59]. The very characteristics that attract some people to remain in—or move to—rural communities, such as lower taxes and less crowding, also make some aspects of rural life more challenging, given scarce resources and underdeveloped economies60. Rural regions have less concentrated goods and services, so people must travel farther to access retail outlets including groceries and pharmacies, medical care, education, recreation, public services, and other key resources. Non-drivers who don't own or cannot drive a vehicle may rely on scheduled fixed-route transit where it is offered, or demand-responsive services if they qualify, for example, for medical appointments. A study of transportation disadvantage in five rural NC counties employed key informant interviews and non-expert resident focus groups, along with mapping of risk factors, to probe the mismatch between travel demand to access key destinations and mobility options available to them[61-62]. Their findings affirmed earlier research on vulnerable populations (specifically, old and young, low-income, physical mobility-limited, English proficiency, and vehicle access), while also producing insights into which residents experience transportation disadvantage, and the formal and informal coping mechanisms adopted by rural residents with limited mobility options.

The sparsely populated rural landscapes of WNC pose specific challenges related to the built environment and environmental challenges related to a changing climate. The ruralness of the region, where a few major cities stand out in a region of many small towns and hamlets, with many residents living an hour or more from the closest metropolitan region, makes the population particularly dependent on road travel for both routine needs (groceries, banks, public buildings) and for infrequent destinations (airports or major retail centers) and acute needs (e.g., medical care). Travel in the region, with its rugged terrain and widely separated destinations, has long been disrupted by events such as flooding, wildfires, landslides, and ice storms, which may force travelers onto long detours or otherwise complicate already onerous travel conditions. The new wrinkle in this travel landscape is the increasing frequency and severity of such events, exacerbated by uncertainty and by communications and coordination challenges in a sparsely populated region that also hosts many seasonal residents and visitors[36]. Emergency management personnel and regional health districts are challenged to provide information about climate-related risks to the population, which may involve decisions and public messaging about preparing for and recovering from both acute events such as flooding or landslides, or serious chronic conditions such as dangerous air quality during prolonged wildfires.

DISCUSSION AND CONCLUSION

WNC is a complex region undergoing rapid changes as a result of biophysical (e.g., climate and land cover changes) and socioeconomic factors (e.g., inequality, economic growth) that produce an array of interactions that elevates the risk and vulnerability of the population. Specifically, the distinctive mountain landscape, with limited road networks and steep terrain, can present particular transportation and economic challenges that are exacerbated by the risk of extreme events (e.g., storms, droughts), and uncertainty about frequency, duration, and severity of these events under a new climate regime.

The unique geography and challenges of WNC are further altered by the underlying populations, which vary in social vulnerability and resilience across the entire area. Although the impacts of climate change are often focused on coastal communities, where hurricanes and sea-level rise will have direct impacts, inland locations like WNC also face unique stresses to climate change, which will amplify current health disparities and environmental health risk.

In general, higher temperatures will increase the threat of heat-related illnesses, particularly among the occupationally exposed, those with underlying medical issues, and rural populations in WNC[14,20]. Threats from high temperatures can impact heat-related illness and exacerbate other illnesses including cardiovascular and cerebrovascular illnesses[13]. High temperatures can also increase the risk of mental health illnesses and crisis events[40]. Regional WNC public health agencies, hospitals, and emergency preparedness staff should prepare for increases in health effects during extreme heat events and for the resources to treat patients. Moreover, programs that alleviate heat stress, such as cooling centers and resources for building weatherization, are needed for the population to address rising temperatures.

Changes in temperature and precipitation will also indirectly affect the distribution of vectors, like ticks, which spread disease such as Lyme disease. As predicted by research disease diffusion models, Lyme disease is spreading into Northern WNC and will likely impact all of WNC in the decades to come. The distribution of other vectors, and the corresponding vector ecology (e.g., bite frequency, geographic distribution) will increase with higher temperatures and alter the incidence of these diseases among residents of WNC.

Extreme weather events (e.g., drought, heavy precipitation) are a normal climatological occurrence in WNC, and communities should be prepared for natural hazardous events like landslides, flash flooding, and wildfires. Building infrastructure situated in at-risk geographic locations, should be developed with caution and account for the potential of such climate and weather extremes.

The environmental impacts from climate change are multifaceted, and include other health stressors like air quality and waterborne disease, which will likely interact with climate stressors discussed in this paper, like higher than average temperatures, precipitation extremes, and weather-related disasters are expected to also impact WNC. Although beyond the scope of this paper, these topics are important and should be considered among the health and climate impacts of WNC residents.

In the future, WNC communities will need to identify ways to adapt to a changing climate that addresses existing health disparities and the risk of emerging and reemerging diseases. This paper provides stakeholders with a current overview of the regional impacts of climate change on human health for the purpose of identifying vulnerability and improving resilience in WNC. Due to the highly variable nature of hazards in mountain environments, policymakers should conduct local-scale assessments of vulnerability and allocate resources to increasing awareness of risks and access to health services. Proactive action to address threats to human health will enable communities to prosper in the midst of a changing climate and may also serve to reduce inequities and enhance economic vitality across the region.

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