Transcription details:

Date:	08-Feb-2016
Input sound file:	188_Huffines_Sports_Med_KenneyHD5

Transcription results:

S1 00:00 We're ready for our next four speakers, we're going to lead off with Dr. Larry Kenne,,y from Penstate University. Please join me in welcoming. [applause].

S2 00:13 Good afternoon, I tried to live my life by very simple rules. Things like never eat at a place called Moms, never play cards with a guy named Dock and never take the stage after the magician who heals children [laughter]. Unfortunately, that's not working out so much today. I'm an environmental physiologist and so my research interest and my curiosity revolve around not only the effects of exercise on health and performance but also the effects of environmental extremes - extremes of high temperatures, humidities, cold, altitude - and along those lines, you can't go very far, pick up a newspaper, pick up a magazine, turn on the television, without hearing about Global Warming.

S2 01:04 So, I'm going to pose one simple question today and try to answer it. And that is, human beings are naked, sweaty, thirsty, smelly tropical animals. We evolved from tropical climates. We're beautifully adapted to tolerate extreme heat but not cold. So from a health perspective, why should we care about global warming?

S2 01:33 The classical studies on the ability of humans to be able to tolerate extreme heat were done in 18th century in England, where a group of scientists took other scientists, and a variety of animals into very hot ovens, essentially, with them. And one of my favorite quotes from this era is that Sir Charles Blagden ventured into an oven heated to 221 degrees Fahrenheit. And in a basket, he took some eggs, a piece of raw steak and a dog. Fifteen minutes later, the eggs were baked hard, the steak was cooked to a crisp, but the scientist and the dog walked out unharmed.

S2 02:20 Humans have a tremendous ability, for short periods of time at least, to tolerate tremendous extremes of hot temperatures, provided:

1. They can sweat and that relies on things like hydration, and heat acclimation, and fitness level.

2. That that sweat can evaporate, and that's a function of the environment and the clothing that we wear.

3. That we don't touch the hot surfaces.

S2 02:47 But humans are tropical animals, we evolve that way. I'm not going to get into controversies associated with Global Warming, but when we talk about Global Warming, it's pretty clear that almost every year now we set a record. We set a record in the United States, we set a record globally in terms of increasing daily temperatures, and there's some questions about whether 2012 was the hottest year on record, or last year was the hottest year on record, but one thing you might consider is that if you're sitting in this audience and you're 29 years of age or younger, not only have you never experienced a cooler than average year, you've never lived through a cooler than average month. So, that's global warming.

S2 03:38 The question is, if these scientists, these climatologists are projecting that the average global temperature over the next fifty years is going to increase by about five degrees Fahrenheit, why is that a problem for tropical animals like us? The answer is that it's not the mean, it's the extremes.

S2 04:01 So, if you look at the curve in the dash blue line, that's the old climate, the climate, let's say thirty years ago, and it's a bell shaped curve, the mean is in the middle, extreme cold on the left, extreme heat on the right. The red line is the new climate, the climate over the last thirty years or so. And so, you can see the peak of that curve has shifted somewhat to the right. That's the change in mean temperature that everybody talks about. But the thing that really matters is the shift in the extreme hot temperatures further to the right because what that means for us is an increased number of environmental heat waves, and an increased severity of those environmental heat waves. So, more and more people of all ages are going to be exposed to, at least short periods, of very, very hot weather.

S2 04:59 In the period of time from the 1950s through the 1970s, when you woke up in the morning you had an equal chance

of that day being of average temperature, shown here in the white, of colder than average temperature, shown in the blue or warmer than average temperature, shown in the red. One-third, one-third, one-third. Over the last decade, this is what that curve has looked like. So, there's been a shift s so you only have a 15% chance of the temperature being average that day, a two-thirds chance of it being hotter than normal, and a 10% chance of it being extremely hotter than normal. So, there's been a change in the frequency, the distribution with that whole curve shifting to the right.

S2 05:56 In 2003, there was a massive heat wave in Europe, centered around France. 46,000 deaths across Europe, 15,000 excess deaths in France alone. Excess deaths mean if you go back on that day in history, year after year after year, you can get a rough idea of how many people normally would die of all-cause mortality on that day. So, on these days in France 15,000 additional people died due to the heat wave. And importantly to my interest, from a research perspective, is that 90% of those victims are over the age of 65.

S2 06:40 And there's a tremendous age bias in terms of morbidity and mortality during environmental heatwaves. There are always a few deaths in infants, and then a huge age bias, so that the older we get, the more likely deaths that occur during heatwaves are going to occur in people in that age group. What may surprise you, and what I think has surprised me over the years in terms of the research that we've done, is what those people die of. You would think-- typically, you would talk about things like heat stroke, dehydration, hyperthermia.

S2 07:18 1995, big heatwave centered around Chicago. There were 450 excess deaths during a two-day period in early July in Chicago in 1995 The temperatures over that three day period hovered around 98-105 degrees Fahrenheit during the day, and that number of excess deaths is shown here in that solid line peaking at around 450. The number of those deaths that were attributable to heat alone, the effect of the heat on the body, elevated body temperatures is really low. Most people are over the age of 65 and the vast majority of them die from cardiovascular problems, either heart disease that's known and exacerbated or underlying sub-clinical cardiac problems that are now faced with an additional stress.

S2 08:23 So you can see, that the relative risk of dying of a cardiovascular event increases with daily warm temperature. Above a daily mean temperature of about 25 degrees centigrade in both men and women. These aren't all deaths, these are deaths attributable to cardiovascular problems. My lab over the past 20 years or so, has been interested in looking at normal physiological aging and how that contributes to these cardiovascular problems that are exacerbated by being exposed passively to high levels of heat stress.

S2 09:06 One thing that happens in humans is as our skin ages, the ability of our blood to die late in the heat, to get rid of the heat that we build up diminishes and the ability of our blood vessels in the cold in the skin to vasoconstrict likewise diminishes. So, the clinical implications are there's a diminished ability to lose heat when its hot, there's an increased risk of heat stroke, but also of cardiovascular strain, and in the cold, we lose heat too rapidly, and that increases our risk of hypothermia as we age, everything else being equal. So, we've been interested in what happens when we put people in the heat, fairly high heat conditions, and we look at their cardiovascular responses.

S2 09:58 It's really hard to be on-site and study people, put tubes in them, put needles in their arm, measure their cardiac responses to an actual heatwave, but what we do is we create a small heatwave and a short heatwave in a laboratory environment by dressing people in waterproof fuse suits. These are lycra suits that cover most of the body surface area. In the inside layer of these suits has a sewn network of coiled tubing. So we pump hot water through those tubes. Subjects are lying there watching television or reading a book. Their skin temperature goes up and then their core temperature starts to go up accordingly. And when we do that, if you compare what happens with young people to old people, in the young subjects skin blood flow goes up tremendously because they're trying to get rid of that heat, but not so much in the seventy year old age cohort.

S2 10:56 And more importantly, the ability of the heart to pump blood to the skin follows the same pattern. Cardiac output, the heart's pumping capacity, goes up significantly more in the young subjects, to a limited extent in the older subjects. So, when you're heated up and you're exercising, you can use the muscle pump, the ability of contracting muscles to push blood back toward the heart so it doesn't pool in the lower body. But when you're passively exposed to heat stress, there's no muscle pump, and the left ventricle provides all of the power, all of the energy to pump all that blood flow to the skin.

S2 11:39 Blood that's pumped to the skin tends to pool in the skin, so there's less blood coming back to the heart and the left ventricle has to work even harder to continue to provide that energy to try to pump blood flow to the skin. So, in older and younger subjects, the amount coming back to the right heart is about the same, but if you look at the ability of the ventricle to contract in young subjects, the stroke volume, the amount of blood that's pumped every minute, either increases or stays the same, but in the older subjects, continues to drop. So, the left ventricle, even in very healthy aging, and we've tested marathon runners, we've tested master swimmers. They're certainly better than the unfit counterparts, but there are changes in the heart, decreased beta adrenergic responsiveness, for example, that accompany the aging process, that leave older individuals - especially those with underlying disease - much more vulnerable to cardiovascular problems during environmental heat waves.

S2 12:49 So, a couple perspectives about how we're going to be aging in a hotter world. First of all, we can predict the increase in heatwave mortality if we know the number of days of a heat wave, the percent of populations on various continents that live in cities, because cities are heat sinks so they tend to retain the heat for longer periods of time, and as I've told you, because older people are more vulnerable, if we know the age distribution of the population, that gives us as a hint as well.

S2 13:24 This was a recent paper that was just published this year. Each of these lines is a continent. The one up to the left is North America and you can see that even though in North America over the next few years, in 2040 for example, we're not expected to have as many heat wave days as, for example, Africa on the lower right. However, we have a much larger portion of the population living in urban areas, and we have a much larger portion of the population over the age of 65. So, we have shifting paradigms. We have climate change that shifts that curve to the right, which results in more extreme heat events, more frequent and more severe heat waves, and we have an aging population that shifts the vulnerability curve in a direction that has a larger vulnerable population.

S2 14:23 So the question I posed at the beginning was, if humans are naked, sweaty, tropical animals, why should we care about Global Warming? And the answer I would give you is number one, don't worry about the mean, fear the extremes. Number two, keep in mind that extreme heat causes substantial cardiovascular strain, and number three that the aging cardiovascular system in both health and disease may be the weakest link. Thank you. [applause].

S1 14:58 Thank you.

S2 14:59 Thanks.

S1 15:00 Thank you, Dr. Kenney. We have a couple questions here. We have Conner W. from here in the audience, "Has there been a recorded decrease in mortality due to extreme cold in certain regions because of Global Warming, and would you still see this as a benefit even with the deaths due to heat waves?"

S2 15:19 There have been some published studies that suggest that if the population of a given city was going to stay the same, the increased risk of cold events would be mitigated by Global Warming, but not of heat events. So, that the shifting part of the curve from the cold side of things is going to continue to move the curve to the right as well, and the problem's still going to exist.

S1 15:49 It looked like it was a little bit skewed to-- the shape of the curve was--

S2 15:53 The shape of the curve changes it as well. That's part of the problem.

S1 15:55 So, I have Jake from U. T. Austin, "On the graph you showed a display in stroke volume decrease in older patients, is the x-axis temperature? If so, is the decrease in stroke volume due to increased pooling or increased sympathetic output and less diastolic filling time?"

S2 16:12 For simplification, I left off the x-axis, but that's a time factor. So, that's what we do in these studies is that we heat all of our subjects, whether they're old or whether they're young, to the extremes of heat tolerance, and this is a very uncomfortable procedure for the subjects. What that sub-- What that line showed was the decrease over time through progressive heating as their skin temperature is clamped and their core temperature continues to rise by a degree or a degree and a half.

S1 16:42 Those are uncomfortable.

S2 16:44 Those are very uncomfortable--

S1 16:46 Uncomfortable studies, yeah. One last question--

S2 16:46 But so are heat waves.

S1 16:46 Yes. And so are heat waves, that's right. "Is there a solution for improving cardiovascular system in extreme heat conditions?"

S2 16:53 We've, as you might imagine, engaged in a number of intervention trials as well. We've done training studies, and certainly that improves the ability to pump blood to the skin and lessens the strain on the left ventricle, heat acclimation, hydration. All the common sense things do as well. We've also looked at some pharmacological interventions. and one of the things that's readily available, that increases the ability of aged skin to vasodilate, is folic acid supplementation. So, we've just finished a series of studies where we've been able to normalize the skin blood flow response, but when we do that, unfortunately, the cardiac output response doesn't track it. So, cardiac output isn't improved because there's no central effect of the folic acid.

S1 17:38 So then you're pulling blood from some place else?

S2 17:40 The only thing that will help improve that blood flow is to benefit Venus return by changing posture and then if there's plenty of blood then it gets pumped out.

S1 17:51 Wear more compression garments, huh?

S2 17:52 No.

S1 17:53 No [laughter]. Please join me in thanking Dr. Kenny for his talk [applause]. Great job. Thank you.