

## **Community-based Disaster Risk Reduction**

**Moderator: Michele Howard**

**Presenters: Mark Keim, MD, MPH**

**Date/Time: August 21, 2012 2:00 pm ET**

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**Operator:**

Good afternoon, and thank you for standing by. Our lines will be in listen-only until the question and answer portion of the call. At that time, to ask a question press star then 1. Today's call is being recorded. If you have any objections you may disconnect at this time. Miss Howard, you may now begin.

**Michele Howard:**

Thank you, Valerie. Good afternoon. I am Michele Howard, and I am representing the Clinician Outreach and Communication Activity, COCA, with the Emergency Communication System at the Centers for Disease Control and Prevention. I'm delighted to welcome you to today's COCA Webinar Community-based Disaster Risk Reduction. We are pleased to have with us today Dr. Mark Keim, here to discuss the importance of Disaster Risk Reduction for decreasing adverse health effects of disasters.

You may participate in today's presentation by audio only via Webinar. Or you may download the slides if you are unable to access the Webinar. The PowerPoint slide set and the Webinar link can be found on our COCA Web page at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca). Click on the COCA calls, the Webinar link and the slide set can be found under the call in number and call password.

At the conclusion of today's session, the participant will be able to state the basic principles of disaster risk reduction and management, identify community hazards and vulnerability that contribute to disaster risk, describe effective risk reduction principles for disaster planning, describe the process for writing a community plan for disaster risk reduction.

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Today's presenter, Dr. Mark Keim is a Senior Science Advisor and Associate Director in the National Center for Environmental Health of Science Office for Environmental Health Emergencies. In addition, he is an adjunct professor at Emory University School of Public Health, and Harvard University School of Medicine. A residency trained emergency medicine specialist, and a fellowship trained disaster medicine sub-specialist, Dr. Keim has provided consultation related to disaster management both nationally and internationally. He has authored numerous scientific presentations, journal publications and book chapters involving terrorism, environmental health, emergency medicine, toxicology, global health, and disaster management.

Again, the PowerPoint slide set and Webinar link are available from our COCA Web page at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca). At this time please welcome Dr. Mark Keim.

**Mark Keim:**

Hello, thank you. Well thank you, very much for joining us today. It's my pleasure to be here. I would like to speak to you about the concept of disaster risk reduction. So the concept of disaster management, or emergency management as it's been called, has undergone an evolution in approaches over the past 20 years. Beginning over 25 years ago with mostly a focus on response in the early days of the civil defense and emergency management agencies in the United States and throughout the world, most of those efforts were based solely on response and that was our only approach to disaster management.

Then over the past 10 to 20 years that response has moved toward preparedness. And the more activity is related to preparedness, especially grew remarkably post 911, when it was seen that in order to have an adequate response we really needed to prepare better and do a better job. This was also preceded by Secretary Witt's work in FEMA with involving moving us in a more broader approach to emergency management. And now more recently, in the past ten years, especially around the world and the past few years here in the United States, the approach is really now addressing risk management. And I'll talk a little bit more about risk management, and then place risk reduction into that context.

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So what do we mean by disaster risk management? The broadest definition and the best source for most of the terminology that I'm going to be using in this particular presentation can be found at the UNISDR Web site, The United Nations International Strategy for Disaster Reduction. And this is from their terminology established as nomenclature in 2009. For the most part is the definition is, "The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to..." and this is the most important part, "...lessen the adverse impacts of hazards and the possibility of disaster."

So rather than relying strictly on the idea that we must have inevitability of disasters in our approach to disasters, this idea here is to lessen or mitigate these impacts, but also prevent the disaster entirely. And you may ask, well how can we prevent disasters? We may not be able to always prevent the hazards, but there are many disasters that can be prevented. And actually many hazards have already been prevented from occurring over the years as well, and we'll talk more about that in little detail in a few moments. So this is the focus of disaster risk management as it applies to the ailments and prevention. So many of you in public health and preventative medicine may recognize these three levels of prevention, of primary prevention, secondary prevention, and tertiary prevention.

And what we're attempting to do in our work at CDC and other work around the world, WHO and United Nations, are to really move that disaster paradigm towards primary prevention. For example, in the first step at the top of the page in that first category, primary prevention, first can the hazard be prevented or avoided completely? And if yes, then implement those hazard avoidance measures. For example, can the flood be prevented by dikes, levies, floodplain management and so on? If not, then the next step is, can exposure to the hazard be prevented or avoided? And if so, then we implement exposure reduction measures. For example, removing people from the area before it floods, removing people, evacuating populations from the coastline before the storm surge occurs. However, in some cases the exposure to the hazard cannot be prevented or avoided. So in that case we ask as a form of secondary prevention, can people's susceptibility to the hazard be prevented or avoided? And then we would implement susceptibility reduction measures. If with - that's not possible, for example, a very good way that we've reduced susceptibility to particular hazards is immunization. Once a person is immunized they are no longer susceptible to the disaster hazard that may be epidemic. And so in that case the susceptibility can be completely prevented, and therefore, the disaster is prevented at the level of secondary prevention. However, for some hazards this still cannot be done. Susceptibility cannot be reduced down to zero so therefore we have to ask ourselves, can resilience to the hazard be improved and implement resilience

building measures. Finally, if none of these first two steps of primary and secondary prevention are possible, or societal will, political will, funding, and so on, are available then we fall to tertiary prevention which is, can the risk be transferred?

Risk transfer is commonly - the most common method of risk transfer is a risk pool, right. For example, insurance companies, or poor countries transfer the risk to larger countries when they ask for assistance after the disaster has happened, and/or individuals may transfer risk to a larger pool when they buy insurance in flood, and so on. The process for risk management here is to first, establish a context, identify risks, analyze these risks, then evaluate them and then treat them. And you can see that we, as I mentioned on the earlier slide, we first want to really identify if we can prevent them completely. By identifying risks we look at the hazards and we also must look at the vulnerability in the population itself. We determine the consequences of what, if the hazard does occur, and its likelihood. And then we evaluate the risks to the public, or to the population, and compare them against criteria, for example, cost effectiveness and so on. We identify these options and then prepare plans. And then evaluate any residual risk, any risk that we cannot prevent. And this comes from International standards, which are now ISO standards. So we previously, 2009, as of - excuse me, previously of 2004. As of 2009 these are now accepted as International standards.

So what is disaster management? I mentioned this earlier in comparison to the overall definition on the left, that on the right here, we have several components. And that's what I want to talk about in a little bit more detail and clarify for you. The first component of disaster risk management is a risk assessment. What is the risk? And, in other words, what is the possibility that the hazard will occur, and then be able to strike a vulnerable population? So, is this high risk, low risk, and so on. And then the next step is risk avoidance. Can we completely avoid that disaster from occurring? For example, by floodplain management, or by other means that may prevent the disaster or the disaster hazard from even occurring. And that's where many of the successes here in the United States have actually occurred, in floodplain management throughout the major river systems. Deaths which used to be very - mortality which used to be very high several 100 years ago in the United States has been brought down to almost zero.

For example, the recent Missouri river floods, a very large area of flooded area, however, very few death in that. So a lot of that risk of health effects was avoided, at least mortality.

Risk reduction means that if we cannot completely reduce the hazard, cannot completely reduce the vulnerability to zero, we then lower it. Or we then mitigate it by lessening the impact, building buildings

that are more resistant to earth quakes, building structures that are more resistant to wind, having land use and legislation and policies that utilize land in a better way in order to reduce the risk. We look, every day, we work in buildings that by a policy have fire codes, have fire suppression units, all of this is as a policy, is built on policies that are built to reduce the risks of these fires - in this particular large fire disasters of major buildings. And so risk reduction is an important component of disaster risk management.

And secondarily, if we cannot reduce that risk entirely, then we transfer the risk, we share it among a larger population of people. And that's one of the mechanisms that's relatively well developed here in the United States. And in the developed world is this idea of insurance companies. Insurance companies that then take the risk from the individual and, by pooling that together, release one individual family from accepting or retaining all of the risk of their home burning down. That's been shared among the entire pool and therefore, it's more financially stable. However, it's actually interesting to keep in mind that actually most insurance companies in the United States, then actually transfer their risks to what are called re-insurance companies. And these are very large insurance companies, all of them overseas, which then insure insurance companies. So if there is a disaster in the United States, our insurance companies, or American insurance companies then file claims with the re-insurance corporations around the world, which then also accept that risk and retain that risk.

The final step of components in disaster management is actually risk retention. And this is the step where we say, we've done everything we can. We've assessed it. We've tried to avoid it. We've tried to reduce it. We've tried to transfer as much as we can. But it still has happened and we need to do something about it. And this is where the step of risk retention involves preparedness and response. And actually moral response and recovery are the main elements of risk retention. In other words, we've retained the risk, we sustained the hit, and now we need to respond and hopefully recover. But the point being, of this talk is that, in many times we, in society, go right straight to these last two things, insuring and retaining risk, transferring it and then retaining it in a recovery mode, which is very expensive on both accounts. Both of them are economically very expensive. Especially in these recent years where we've had record years of disasters in the United States.

And so the idea of disaster risk reduction is to move that, to shift that paradigm towards prevention, which is the logical public health approach. And let's talk a little bit more about that. So risk management versus risk reduction, risk management as you'll recognize of the left here has all the stages, prevention, mitigation, preparedness, response and recovery. Risk reduction focusing on those events that are pre-event, prevention, mitigation and preparedness. They occur before the disaster and they're meant to

lessen the likelihood of the disaster occurring in the first place. Lessen the likelihood of a public health emergency occurring that would result in excess morbidity and mortality among the population.

So we can see this disaster risk management concept applied to the typical emergency management cycle. And those of you that have worked in emergency management before will recognize the emergency management cycle, mitigation, preparedness, response and hopefully recovery. And when I say hopefully recovery, what we're finding is that the cycle, when repeated rather rapidly, when disasters occur very frequently in many areas, or when disasters of large magnitude occur, such as Hurricane Mitch in the Central America's several decades ago, it actually prevents recovery from occurring. So they get in a spiral rescue. And it's very bad and very difficult for sustainable development to occur. But if you can look above this line, we're looking at the elements of disaster risk management at our pre-impact. These are considered to be risk reduction measures. Below the line are post impact or risk retention measures. And so I want to compare these two for you. The risk reduction measures largely are delivered pre-impact. They're actually found to be the most cost effective. As a matter of fact, depending on which study you read, FEMA which says that for every \$1 spent in risk reduction measures \$4 are saved in risk retention response and recovery costs. The World Bank actually has estimated this number to be between \$10 to \$20 saved for every \$1 spent at risk reduction. So they're more cost effective and importantly as well, most risk reduction measures are community based. And that's a real important reason why we, as community health providers, as Medical Reserve Corps, other groups that are working at the community level, public health agencies and so on, this is our unique mandate. Because disaster risk reduction is largely implemented at the community level. And this aspect is also very empowering, because it empowers the community to make their own decisions, to identify their own risks and to change those accordingly.

The final aspect of risk reduction measures is that they are more sustainable. It's easier to be able to do risk reduction measures over time when they're based in sustainable development, when they're based in developmental policy. If you have a choice of where to build your next hospital sooner or later you will build a new hospital in your community as time goes by. Or you may have an opportunity to build other critical infrastructure. The choice that you make in where to put it, to put it in a hazard zone, makes it less sustainable, whereas over time you're going to be building these buildings anyway, building them in a sustainable manner makes much more sense. Now in comparison to risk retention measures, these are delivered post impact. Many times they're delivered ad hoc, they're delivered in a hurry. They're also very expensive when they are delivered as well. So they're least cost effective. The money has to flow very, very quickly. There's a large amount of waste. Internationally there is also a well-known phenomenon of misappropriation of these funds when they flow very quickly to a large variety of agencies. So it's also

least cost effective. In addition, it's also nationally and internationally based. People from outside your community come in and do the work. And sometimes people from other countries come in to a second county and do the work, do the response and do the relief work, which can actually have impact in changing the culture itself. Not to say that all humanitarian relief is bad. But in comparison to the kind of more moderate, and more thoughtful, and more timely risk reduction measures you can see that there's quite a bit of difference in the comparison.

So I want to compare these different models, and different techniques that we talked about. Of prevention, of emergency management as many of the emergency managers in the group, FEMA folks, would recognize. And then risk management and then disaster risk management. It's basically just to get a little bit better idea of how these things fit together. As you can see in primary prevention, the phase of the emergency management cycle would match that completely as prevention. The risk management technique would be risk avoidance and the disaster risk management component would be hazard avoidance, in other words, preventing the hazard from occurring completely. A hazard avoidance meaning preventful fire prevention and, you know, we've seen many of these types of programs and not recognized them as disaster risk management, for example, as I was growing up it was Smokey the Bear, and then later on it was "Learn not to Burn", and all these types of programs that are developed on trying to avoid the hazard because the residual risk and the vulnerability is very high.

So in the next stage of prevention, secondary prevention, phase of emergency management cycle actually is two-fold. One of them is preparedness and the other is mitigation. We can recognize preparedness and mitigation. Preparedness - behavioral aspects taken before the disaster occurs, in order to be able to respond more effectively. Mitigation are structural and financial aspects that are taken to lessen the impact. So once again, preparedness in mitigation, we're trying to lessen the impact of the disaster once it does occur. If we haven't avoided the hazard completely but we're preparing and mitigating so that when that hazard does occur we can lessen the disaster itself. Risk management technique would correlate with risk reduction and risk transfer, as I've talked about earlier. And then disaster risk management we would be focusing mostly on vulnerability reduction. The hazard is - we haven't been able to avoid the hazard but, how can we avoid the vulnerability of the population themselves to becoming injured or becoming ill as a result of the disaster?

We in public health focus on those two aspects, but other areas, other sectors may focus on social-economic vulnerability, or social vulnerability, and so on. We in public health have the unique mandate to focus on health vulnerability. And we'll talk more about that detail. Tertiary prevention is the final stage of response and recovery, as it would be known for most people in the emergency management cycle. Risk

management would call that risk reduction and disaster risk management would refer to that as residual risk. Once again, after the disaster has occurred, trying to at least minimize the amount of impact that that's had. Let me point out the difference between prevention in these different cycles, primary prevention, secondary prevention and tertiary prevention in the effectiveness, for example. Let's look at the example of Hurricane Katrina where over 1000 people lost their lives due to the storm surge that occurred. So the storm surge is the wall of water, or the flooding that occurs when a hurricane makes landfall. Typically it can be several meters high of water comes in while the hurricane is making landfall. When no emergency, or very few emergency medical services are being provided in the community.

Most of the time, as a matter of fact around the world, 95% of all deaths during a hurricane occur at that phase when emergency medical relief has not yet been sent out. After the landfall is made, that's when we send out our medical services throughout the world, medical teams and so on. But 95% off all deaths have already occurred at that time. So of course response and recovery are very important for reducing additional risk, but you can see if we rely entirely upon response and recovery for the hurricane related deaths around the world, we'll be losing the opportunity to save 95% of those lives, just by the statistics alone. So we really have to be thinking more about prevention, and mitigation, and preparedness in these reigns.

So how do we estimate this disaster risk? I've been using some words like vulnerability and hazards, and so on. This is basically just a rough equation. It's not meant to be strictly quantifiable because there are still some challenges in being able to mathematically define this as an accurate model. But I find it a very helpful way to conceptualize how we can reduce disaster risk, where  $D$  is the risk of the disaster, these are all probability statements.  $D$  is the risk of the disaster,  $H$  is the probability that the hazard is going to occur. For example, the probability of a flood, a 100 year flood, a 1 in 200 year flood, and so on. And then the vulnerability to the population, how vulnerable is that population to that hazard? For example, if the hazard is polio and we've all been vaccinated, then the vulnerability of our population is 0. Therefore, the probability of a polio disaster is 0. So our main goal is to try to lower that number, lower that probability of disaster, and if we can make either the hazard or the vulnerability equal to 0. So that's our goal.

Now moving on and further defining where vulnerability - what are the components of vulnerability. Vulnerability can be seen as the - the components can be seen as it can be comprised of, excuse me, of exposure, and susceptibility and resilience. So vulnerability is equal to exposure, and susceptibility and then also lessened by resilience. So if we are more exposed to the hazards, probability goes up. If susceptibility is higher our vulnerability goes up. If the resilience is higher it actually lowers our vulnerability. So let's take a look at those individually as those individual components, because we in



public health and the medical professions can actually lower this vulnerability. And I would propose to you that when it comes to health results, this is our unique challenge and mandate, is to lower vulnerability. Because we in public health have very little say so when it comes to stopping the hazard. We can't stop the hurricane, but we can stop the people's exposure to the flood waters that cause deaths, and so on.

So most of these disaster risk assessments actually look at two different components. They look at the hazard and they look at the vulnerability. Because without a hazard there is no disaster, without vulnerability there is no disaster as well. A hazard can occur out to sea, for example, never hit a population of an island, it would then only be a hazard. So therefore, the disaster does not occur. So with no vulnerable population, in other words the  $V$  equal to 0, no disaster. These disaster risk assessments are very broad. They're not, at this point in time, accurately quantifiable, but they give us a basic idea of the way that we can actually look to lower each one of these components. For example, the first step in the hazard analysis is just to merely identify the hazard in your community. What are you faced with? Do you live in the Midwest and faced with tornados? Are you on the coastline and maybe facing hurricanes? Obviously people in Montana don't worry so much about hurricanes, people down in Florida don't worry so much about heavy snowfalls.

So first identifying the hazard. And then the hazard likelihood of occurrence, how likely is that hazard to occurrence? And for some hazards we actually have pretty good records of how often they occur. For example, seismic disasters like earthquakes and volcanic eruptions occur relatively stable over a period of time. Low frequency, of course, but their likelihoods can be at least somewhat predicted, although not down to the - we're talking in geological timeframes, not necessarily in specific years. But floods also the same way, we predict floods in the number of times that a flood may occur in 100 years. And that's probably one of our most accurate predictions. In addition also, tornados, tornado warnings and predictions now, with the new technology, Doppler radar and so on, have increased our ability to actually predict the likelihood of the occurrence. So if you, number one, identify the hazard that you're in a tornado prone community, the hazard likelihood of occurrence can be predicted relatively well. We can also then look at what is the impact, for example, what are the damages that can be done by each one of these hazards. And more importantly for us in public health and medical professions, what is the potential medical impact as well?

And then - but separate from that - many people stop there. They stop and they look at the hazards and say, what are the potential impacts, and let's plan for that. But now disaster risk assessment and disaster risk reduction has a very important component of vulnerability analysis. We have to look at the vulnerability of population, because each one of these factors makes people more prone to be killed, or

injured, or become ill in a disaster. For example, the demographics, gender, male versus female, the age for example under the age of 3 or over 65, more prone. Sociopolitical or socioeconomic status, lower socioeconomic status many times means a higher risk for disaster rate at death, or injury. There are certain cultural moors and certain cultural aspects that make some cultures, some people with certain cultures, more prone to becoming ill or killed in a disaster. Ethnicity as being a minority or under privileged minority in any country can also be an indicator, or driver, towards more vulnerability. Also, people with poor health status, chronic diseases, physical disabilities, all of these are indicators of vulnerability, and therefore increase people's death, likelihood of death, due to these given hazards.

So given the same hazard, different people are more vulnerable. Given the same hazard of flooding, for example, children under the age of 3, adults over the age of 65, under privileged population, a low socioeconomic status and so on, many of these vulnerability indicators make you more likely to become ill, or to be killed in the disaster. Something with developmental difficulties as well, contribute to the same issue. Or this aspect of a social development. Social isolation, for example, makes you more prone to die in a heat wave in inner city, as compared to other types of indicators as well. So not only physical development but also a social network and so on, also contribute to these facts.

And so, you can see that these vulnerability indicators are actually indicators that we in the public health and medical profession, we deal with these on a daily basis in most of our work. We identify these kinds of factors for many other things, for diabetes, for tobacco, for sexually transmitted infections, and so on. So in many cases we're already dealing with these and this is what we should be looking at when we start talking about these environmental disasters, and preventing them and mitigating them. So I just want to give you just a broad idea of when we're talking about some of these impacts, how people can put these into categories. And I don't want to spend a lot of time on these specific numbers because they're only relative to each other. They're not absolute values. But you can see, for example, we can choose a hazard and estimate its impact, in the first column, estimate its likelihood of occurring, and then the overall probability of the hazard is a function of the impact times the likelihood, here in the third column.

The vulnerability, for example, we can also have an estimate and then risk by multiplication of simply the hazard and the vulnerability. And this is a very basic assessment that was performed for the 2010 World Exposition in Shanghai, China, where they wanted just a rough idea of what were the top hazards that they had to worry about when we looked at, taking into consideration factors of impact, likelihood as the hazard. But also, the vulnerability of the population, which was relatively unique in this situation.

So what is a hazard? The definition of a hazard is the dangerous phenomenon, substance, human activity or condition that can cause the loss of life, injury, or other health impacts. It can cause property damage, loss of livelihoods and services, economic disruption or environmental damage. And we're most focused on that loss of life or injury, or other health impacts. So this is an example of different types of hazards. We have typhoons, floods, you can have hazardous materials like radiation, earthquakes, tornados, outbreaks, all of these are considered hazards. Only when they are associated or come in contact with a vulnerable population is there a possibility of disasters. So we must not use these terms interchangeably. A tornado is not necessarily a disaster. It's simple a hazard unless it actually causes damage. Same thing with earthquakes, same thing with these other types of disasters, and so on.

So what is vulnerability? Vulnerability according to the U.N.'s definition is the characteristic and circumstances of a community system or asset that makes it susceptible to the damaging effects of a hazard. Or simply put, it's likely to incur physical or emotional illness or injury. So that's, in the broadest sense, what we mean when we say vulnerability. So public health vulnerability in certain populations are more vulnerable to disaster related morbidity and mortality than others. As I mentioned, children can be more vulnerable to certain hazards. Elderly, for example, when we look at refugee populations we can also see the under five mortality rates are a very sensitive indicator of the phenomenon of disaster, as it is occurring. For example, either in nutritional emergencies, or in infectious disease outbreaks. And so we have to realize that certain populations are more vulnerable. For example, the elderly isolated, socially isolated elderly in inner cities are more susceptible to the heat wave disasters that occur. So not everyone has the same vulnerability and therefore, not everyone has the same risk for disaster given the same hazard. And these are some factors that have been noted to increase public health vulnerability. It's not meant to be an exhaustive list, but merely to give you an idea of some of the factors, including poverty, which is one of the most significant. Poor people, as the former director for the United Nations Office for Coordination of Humanitarian Affairs said - he (unintelligible) and said, disasters seek out the poor and bind them in their poverty. And they do so within each society. They not only seek out poor countries, but they seek out the poor in even rich countries. These other factors that increase public health vulnerability disasters, extremes of age as I mentioned, gender, disability, lack of information and education, lack of experience or process, inadequate healthcare systems before the disaster means less medical care after.

Sometimes geographical isolation of a simple location, inadequate preparedness and mitigation, ethnicity, poor water and food quality, high burden of illness and injuries and so on. So we can see there're many different wide variety of factors that can come into play. Some of these can be affected by public health and medical interventions, and some of them are more of a policy or developmental approach. However, if public health is to lower the vulnerability, the health vulnerability in disasters, we should be working with

these other sectors to identify some of the social and the developmental flaws that are causing disaster deaths. So as I mentioned, vulnerability is this mixture of exposure, susceptibility, and resilience. All three of these elements, these three components come together to create vulnerability.

So as we talked about, what is vulnerability? What do I mean by susceptibility? Susceptibility is the state of being at risk, if you're exposed to the hazard. So for example, you may be exposed to the hazard of water. And if you're not able to swim you are more susceptible than someone who can swim. We can use this in an infectious disease example of susceptibility. If exposed to a particular pathogen, then if you've been already immunized then you are no longer susceptible or have a very low possibility of being susceptible to this particular hazard. So therefore, the susceptibility is an important part of our ability to disasters. And what do we mean by resilience? Resilience is the ability of a community or society that is already exposed to the hazard to resist, absorb, accommodate and to recover from the effects. And I say that carefully because resilience implies that you are exposed to the hazard, you've already taken the exposure, which I think is an important thing to recognize. Resilience accepts exposure and therefore steps past primary prevention. And we're already now missing the opportunity to prevent exposure, and now we're talking about resisting and absorbing. Resilience in the definition in Webster's dictionary is basically the ability to return to its original state. And in that sense we're trying to recover, we're trying to resist or absorb the disaster itself. And I think that's important because a lot of people use the word resilience in talking about a broad variety of things nowadays, and use the word resilience almost as though it could actually involve prevention, as though it may involve mitigation and so on. And I like to say that resilience is for survivors. If you've been exposed to the hazard and unfortunately your health has suffered to the point where you have died, you're unable to be resilient. And I think that's the difference between engineering resilience and ecological resilience, compared to health resilience in that sense, is that in community resilience, if the community is destroyed the buildings, the infrastructure is destroyed, it can be rebuilt if it's completely destroyed. However, the human being's health completely destroyed we cannot rebuild. And so we have to be careful when we're talking about applying the concept of resilience. Very important, very key element in community resilience in modern approaches now, but we have to be careful when we're talking about falling to resilience as being our first step.

We shouldn't give up the opportunity for prevention and mitigation of these hazards so that we either prevent the exposure or we at least reduce it through mitigation. An example of resilience would be, for example, living among healthy people who can help you. That's an element of response and recovery. People can actually help you.

There's an example of resilient community, though many other formal definitions, but just to give you a broad idea of what I mean when I say that when resilience goes up, vulnerability to disasters goes down. So vulnerability assessments can consider key factors that affect public health vulnerability. So we can measure, for example, socio-economic status, we can measure demographics, economic indicators, education, language, language skills, health status, health indicators, healthcare access. We should be taking all of these in consideration when we're addressing the vulnerability of a community, not merely just its infrastructure, not merely just the number of ambulances or the number of hospitals or hospital beds, or number of ventilators. But many of these other factors which are main contributors to morbidity and mortality after disasters.

So I want to show you when we start talking about the human vulnerability, this is vulnerability map currently being created by our Geospatial Research, Analysis, and Services Program at ATSDR and CDC. And this came of an idea that I had a few years back in working with Jenny Lee at CDC also. I said, you know, this formula is all well and good, and it's all a matter of being able to sort of visualize, what is vulnerability and where does it lie? So I want to show you, when we start talking about applying these concepts of vulnerability, what are the possibilities to be able to lower morbidity and mortality? What you're looking at here is actually several different maps of Miami-Dade County. We all know that Miami-Dade County has the likelihood of having flooding due to hurricanes. And that's a common occurrence. In the upper left corner you see the pink and sort of a brick colored map there, that's the U.S. Census Tracts percentage population, with the lightest color being 0%-5%, darker 6% to 20%, darker than that 21% to 40%. And then the very dark, over 40% of these individual Census Tracts are people that live under the poverty level.

So you can see those darkest dots there are actually the people with the highest level of poverty. And then, now let's take a look down below that to the U.S. Census Tracts percentage age 65 or older. And you can see once again a little bit different mapping there. The 0% to 10% of the population that are age 65 or older in the very light, and then 11% to 20% darker, 21% to 50% of the Census Tract is 65 years age or older, and then the very dark ages, as you can see over here on the right side are greater than 50% of those individual Census Tracts are age 65 or older. Now if you take a look at the map above it and the one that we just looked at, we'll place those both together now and that's this very large slide here. So what we've done is we've taken the percentage of poverty and elderly combined together. And we've put those in low, medium and high. And the darkest brick red colors are those people who have the highest level of poverty, as well as the highest percentages of elderly population in those Census Tracts.

So now we can look at Miami-Dade County, the area that's flood prone, and find the most vulnerable population. And let me take a look at this with you. That's right on the coastline. You can see that's right where the storm surge would be occurring. So we can identify that we have a disaster waiting to happen. We have high vulnerability. And we have the high possibility of a hazard occurring there. So therefore, we can say that the risk is much greater there. And by having this map ahead of time can do several things. We can prevent that by changing that developmental structure over time, changing where the population lives, over time. I'm not saying move people out today but making long-term sustainable development decisions to take high risk populations away from high hazard areas. And to lessen that by simply developmental and land use changes.

As well, secondarily what we can do is we can also develop preventive measures by reducing exposure. We can need help to evacuate these people from these areas, for example, before the hurricane strikes ground. So if there are high risk areas that should be evacuated we can focus our efforts. For example, Neighborhood Watch style programs. If you know someone in these areas that needs help in being evacuated because they're either impoverished or over 65, that's where the resources can go first. Then also, not only in prevention and not only in preparedness, but actually in response. If I have only a few resources available to me, immediately after the response now I know high risk areas where I can start focusing my resources. In addition, recovery, this type of map and mapping process is now being used in New Orleans to re-identify high vulnerability areas and be able to try to change that development over time. In other words to build back better the next time with a lower risk by identifying vulnerability. So you can see we in public health, in identifying vulnerability, can really - we really have a lot of opportunities here to be able to reduce disaster deaths in the long term.

So how can we do so? How can we reduce our vulnerability to disaster? So number one is that disaster reduction occurs at the community level. And community health sectors can play an active role in reducing human vulnerability by simply, healthy people, healthy homes and healthy communities. Healthy people are less likely to die during disasters. So by making people healthier, lowering the burden of disease and lowering the incidents of adverse health effects we can reduce our susceptibilities. In addition, healthy homes, the locations of the homes, the style of homes that we choose and so on, make a difference in reducing our exposure to these elements. And also, the location of the homes, is it on a floodplain, is it on the coastline, and so on. And then also increasing resilience, in other words, healthy communities that work together in order to respond effectively, prepare effectively and also try to recover together as well. Vulnerability reduction, there are many aspects that we can do to reduce the exposure is one of the three components of vulnerability. One of the most successful has been floodplain

management, the use of dams, levees, weirs. That's one of the major success stories here in the United States that other countries are still trying to emulate.

There's a lot of work right now in the People's Republic of China in managing the floodplains that have caused millions of deaths in that country over the past century. Other countries are making success in the same way. Scotland, for example, is establishing a series of weirs that are also expected to reduce their exposures. Population protection measures, for example, in evacuation of populations. And that was the real lesson learned at Katrina was to evacuate the population before the hurricane strikes. The very next year People's Republic of China had a very severe typhoon strike their coastline and they evacuated over 1 million people in advance of the disaster itself, having learned that lesson from Katrina. And also, mass care, protecting the population in sheltering. And so a remarkable job done by the Red Cross and other members, and supported by many other local volunteer groups like the Medical Reserve Corps. And also land use and planning and regulation, not building critical infrastructure, or not posting high risk housing with house with vulnerable population, public housing, in areas that are at high risk.

And even in the sense of infectious diseases, we reduce exposure by use of personal protection equipment, by hygiene, by sanitation. Those are aspects that we routinely use to reduce exposures in order to reduce the risk of these disasters. And reducing susceptibility is basically a concept of health promotion and healthcare. By promoting health, by making an healthier population, by reducing the burden of chronic disease, chronic illness, by reducing the numbers of disabilities, by reducing toxic exposures, by reducing the kinds of adverse health effects that come in both developed, as well as under developed nations, we are reducing the susceptibility to dying in a disaster. Poverty reduction reduces people's susceptibility. Community planning reduces susceptibility, as well as immunization reduces the susceptibility to infectious disease. All of these are components that in many areas public health is a very active player.

So there is a National Prevention Strategy that fits very well into this idea of reducing susceptibility. It identifies goals and priorities, and it recommends and makes grounds of recommendations in evidence based practice. These are efforts like Healthy People 2020, the National Quality Strategy, the First Lady's "Let's Move!" campaign, America's Great Outdoor Initiative. So public health is already focusing on the prevention strategy which actually, by default, lowers susceptibility to disasters. Of course, when the strategy was developed it wasn't intended solely for that purpose, but we in public health, when we apply this National Prevention Strategy, and especially if we apply it in high risk areas, in areas where there's other reason for vulnerability, due to exposure or hazards, we can lessen the vulnerability to disaster related morbidity and mortality as well.

And just click one more as I go ahead and go through this. This is just a representation of the National Prevention Strategy as you can see, health and safety community environments, clinical and preventive services, empowered people and elimination of health disparities. And increase the number of Americans who are healthy at every stage of life. So this very much goes along with the idea of reducing disaster vulnerability. So now we can see that there is a more holistic approach in public health and in medical profession that works even in times when there is no rain. In times when there is no heat. In times when there is no earthquake. That we can actually, by virtue of public health and by virtue of medical care on an ongoing basis, work to lessen our disaster - our vulnerability. And I think that's one of the important parts that make this much more cost effective and have a really, a no remorse or no loss approach to this.

Those are file E programs, yes. Priorities of course, of this National Strategy, tobacco free living, preventing drug abuse, healthy eating, active living, mental and emotional well-being, reproductive and sexual health, as well as injury and violence free living. And so I just wanted to point out once again that these are the kinds of things that we can also work together to reduce vulnerability. Vulnerability reduction can be thought of also as the six R's of resilience, readiness, robustness, redundancy, resourcefulness, and rapid response, as well as recovery. And you can see, most importantly readiness as being the key elements of this. And finally, human resilience as a means for vulnerability reduction, you know, resilience being the ability to cope with and recover from disasters. And so these are human behaviors that increase disaster resilience, preparedness, response, and recovery. Those are the key elements, key activities that we can perform in order to increase our resilience, and thus reduce our risk for disasters. We have to be careful though not to rely entirely upon resilience because in many hazards we can only effect a very small percentage of the population.

I also want to point out that resilience has been described for many years in the disaster ligatures that adaptive capacity, or absorptive - excuse me, adaptive capability or absorptive capacity. So it's not only the ability to adapt, but also the capacity, in other words, how many resources do you have available in order to respond? How many resources do you have available to recover? So if you look at capability and capacity in an example, a glass of water has the capability to quench thirst. It's capacity is either is half full or half empty. So the difference between these capacity and capability, so we have to look at resilience in these two methods. One, what are we capable of doing? And number two, how much are we capable of doing?

And so that varies from country to county, it varies from individual to individual, it also varies from community to community. So it's an important part of resilience, is this idea of capability and capacity.

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And finally, I want to leave you with the 11 E's of emergency preparedness. Just an easy way to remember that those elements of preparedness, evaluation and monitoring of a hazard, early warning, evacuation, emergency operations planning or disaster planning, education and training, exercises and drills, engagement of the public, electronic media and communication, epidemiology and surveillance, equipment and supplies, and also economic and political incentive. All of these come together to form emergency preparedness programs, of which many of us are already familiar. Over the past decade many of us have been involved in the rise of emergency, public health emergency preparedness in the United States. And it's development and maturation.

So finally I want to ask you to think about this exercise, how can the Medical Reserve Corps units or volunteers in the community, how can anyone, healthcare providers and so on, reduce the risk of disasters in your own communities? And just think about the difference between epidemics and cyclones or floods. In epidemics we reduce exposures by social distancing, by personal protective equipment. In floods we reduce exposures by dams, or we actually evacuate the population away from the disaster when the flood does occur. Epidemics we reduce susceptibility by immunizations. Floods and cyclones we reduce people's susceptibility by health promotion. By teaching people skills that they can help themselves in, for example, swimming, or skills in being able to evacuate and being able to recognize the warning signals. Skills in being able to develop their own health promotion, for example, health kits and emergency kits. Epidemics we increase resilience by an adequate medical system, by a response system that has adequate antibiotics, intensive care units, tertiary care and so on. In the same way we increase resilience after floods, after cyclones, by emergency preparedness and response activities, national disaster medical assistance, FEMA responses, community based responses as well.

So we can see that this model of reducing vulnerability by reducing exposure, reducing susceptibility, and increasing resilience can apply in both natural environmental disasters as well as infectious disease disasters. And that's all for my talk for today. And I want to thank you, very much for your attention.

**Michele Howard:**

Thank you, Dr. Mark Keim, for providing our COCA audience with such a wealth of knowledge. We will now open up the lines for the question and answer session. And as always, you can also type your questions through the Webinar system by clicking on the Q&A tab at the top of your screen. Operator.

**Operator:**

Once again, to ask a question on the phones press star then 1. One moment. (Norman Castelle) you may ask your question.

**(Norman Castelle):**

Yes, how do we get access to the geospatial information for - to get it for my local area?

**Mark Keim:**

So the question is, are you speaking specifically of the vulnerability mapping process?

**(Norman Castelle):**

Yes, with ages and poverty and so forth.

**Mark Keim:**

Yes, there is a program here at CDC known as GRASP, and they're actually in the ATSCR, and they have an ongoing program that provides technical assistance to communities in the state. They can assist you in either developing maps of your own, or actually in some cases, can develop these maps.

If you would like to check on the Web you can find them on the CDC Web site under GRASP, or if you like you may send me an email and I'd be happy to refer you to them. My email address is mjck9@cdc.gov, that's Michael, Juliet, Kilo, Number 9, at Charlie, Delta, Charlie dot Golf, Oscar, Victor.

**(Norman Castelle):**

Okay, thank you.

**Mark Keim:**

You're very welcome.

**Operator:**

There are no further questions at this time.

**Michele Howard:**

Are there any further questions?

**Operator:**

There are no further questions at this time. But we do have one that just came up. (Joan Keenan) your line is now open.

**(Joan Keenan):**

Thank you, I was not able to get to the slides. Can you give me the email address again?

**Mark Keim:**

Yes, actually if you can - if you'll go to the original invitation that you received where you found about this particular COCA Webinar, the slides have now been posted. So you can download them directly from the Web yourself.

**(Joan Keenan):**

Okay, well I wasn't able to login on Internet from that invitation. There was some kind of error. So will they be posted on the CDC Web site?

**Mark Keim:**

Yes they will. As a matter of fact, and also I'd be happy to direct you to that Web site if you'd like. Did you get my email address? Did you need that again?

**(Joan Keenan):**

Yes, I wrote that down, mjk9@cdc.gov?

**Mark Keim:**

That's right, if you send me an email I'd be more than happy to give you the Web link that takes you directly to the slides themselves. It doesn't direct you through the Webinar process.

**(Joan Keenan):**

Okay, thank you, very much.

**Mark Keim:**

You're very welcome.

**Operator:**

There are no further questions.

**Michele Howard:**

Again, thank you for joining us today. We would like to apologize for the inconvenience with accessing today's COCA Webinar. On behalf of COCA I would like to thank everyone for joining us today, with a special thank you to our presenter, Dr. Mark Keim.

If you have additional questions for today's presenter please email us at [coca@cdc.gov](mailto:coca@cdc.gov). Please put August 21 COCA Call in the subject line of your email and we will ensure that your question is forwarded to the presenter for a response. Again, that email address is [coca@cdc.gov](mailto:coca@cdc.gov).

The recording of this call and the transcript will be posted on the COCA Website at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca) within the next few days.

**Mark Keim:**

Excuse me, moderator, I notice one question that we have from a (Kendra Stross-Riggs). Is that a written or verbal question? Are you still with us (Kendra)?

**Operator:**

Yes, it must be a written question, sir. It's not on the phone side.

**Mark Keim:**

Okay. All right, I'll be happy to provide a written answer then.

**Michele Howard:**

We can go ahead and answer that if you would like. The question regards linking emergency and disaster preparedness to the National Prevention Strategy is not always widely done. How can we introduce more of this kind of conversation into the field?

**Mark Keim:**

That's a very good question, and I really appreciate that, because that's exactly what we're trying to do. You can see there's been a lot of talk about response. We've spent hundreds of millions of response dollars throughout the United States. I mean, we've done a great job of improving preparedness.

But what we haven't done is really talked about how that links together with National Prevention. How these things are a very holistic approach. It's almost as though public health and medical approaches to these things wax and wane as the funding cycle - as the hazard is forgotten.

And the real issue here is, by linking disaster risk reduction to a National Prevention Strategy you're really focusing on a long-term effect. A more sustainable effect as well, because the National Prevention Strategy is going on and on. And so I think that that's important to recognize that and I appreciate the fact that you have. How can we introduce this more? Well, you know, this is the intent right here. These kinds of Webinars, sharing this with your community as well, downloading the slides and sharing those with your colleagues in opportunities that you have to be able to discuss this.

There's also have been some publications in the literature that talk about the linkage between health prevention, health promotion, as well as risk reduction. Another great resources for disaster risk reduction is the United Nations International Strategy for Disaster Reduction Web site. That's [unisdr.org](http://unisdr.org) and there you can find a lot of information about disaster reduction. And actually, because the United States has focused so much post 911 on preparedness and response, we've been very lucky, we've been very fortunate because we have the resources to be able to spend on these very, relatively expensive measures. But in that period of time the world, much of the world has actually been focusing on risk reduction because it's cheaper, it's more cost effective for them, and they simply don't have the dollars to put into response and recovery even if they were more effective. And so, you can see many of the kinds of successes that have been occurring in disaster reduction that link health promotion and prevention. So I would say, focusing that at the community level, supporting the National Health Prevention Strategy, and bring the faster risk and reduction to the table whenever possible is a way to introduce this conversation more into the field.

**Michele Howard:**

Thank you, Dr. Keim.

**Mark Keim:**

Okay, any more questions?

**Operator:**

There are no further questions on the phones.

**Mark Keim:**

All right, well once again I just want to thank you for the opportunity to be able to share this with you and I appreciate your attention. If there is anything else, any other questions that you may have of me, please feel free to contact me and I'd be happy to respond to them. And thank you, again.

**Michele Howard:**

Okay, thank you. Free continuing education credits are available for this call. Those who participated in today's COCA conference call and would like to receive continuing education credit should complete the online evaluation by September 20, 2012, using the course code EC1648. For those who will complete the online evaluation between September 21, 2012 and August 20, 2013 use course code WD1648. All continuing education credits and contact hours for COCA conference calls are issued online through TCE Online and the CDC training and continuing education online system at [www2a.cdc.gov/tceonline](http://www2a.cdc.gov/tceonline).

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Thank you again for being a part of today's COCA Webinar and have a great day.

**Coordinator:**

Thank you. This does conclude the conference. You may disconnect at this time.

**END**