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It's Too Darn Hot!

Arizona Climate & Health Effects

2012 Arizona Infectious Disease Training & Exercise

Arizona State University

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Leadership for a Healthy Arizona



Extreme Weather and Public Health Program

- Created to develop capacity and adaptations to reduce the health effects of extreme heat on Arizonans
- Develop climate change programs
- Increase knowledge of healthy responses to excessive heat situations



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Program Goals

- Identify risk factors and adaptation strategies to improve healthy environments
- Enhance current surveillance systems
- Promote awareness of climate implications on public health



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Population Risk Factors for Heat-Illness

- **Age**
 - Children under 5 years old and adults over 65 years old are most vulnerable
- **Obesity**
- **Chronic conditions**
- **Recent Illness**
 - **GI and Respiratory**
- **Dehydration**
- **Certain medications**
- **Heat Acclimatization**



Images from Microsoft Clip Art

Co-morbidities



(Image from Microsoft Clip Art)

- Respiratory conditions
- Cardiovascular disease
 - Hypertension
- Depression or other psychiatric illness
- Obesity
 - **Fat layer decreases the ability to release heat**
- Diabetes Mellitus
 - Type I and II
- Hyperthyroidism

(Kenny, Yardley, Brown, Sigal, & Jay, 2010)

Health Outcomes

- Heat-illnesses
 - Heat cramps
 - Heat exhaustion
 - Heat stroke

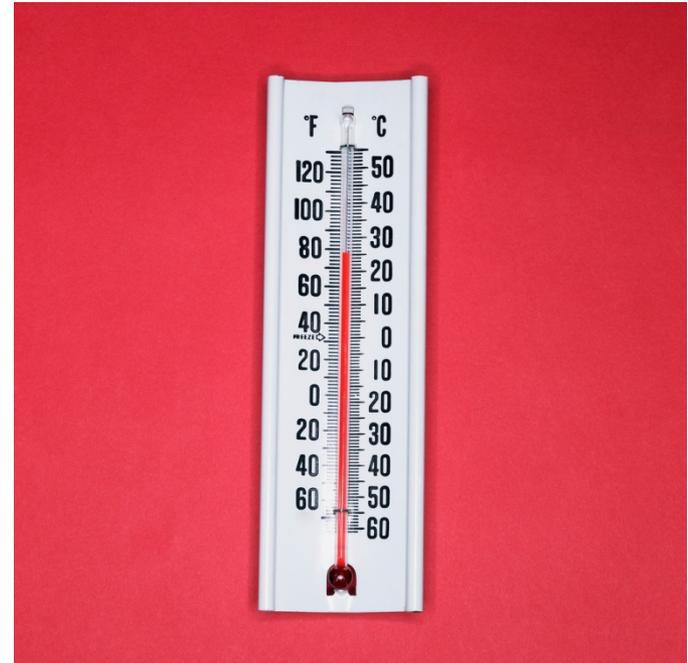


Image from Microsoft Clip Art

Heat Illness Morbidity

Year *Statewide* *Apache* *Cochise* *Coconino* *Gila* *Graham* *Greenlee* *La Paz* *Maricopa* *Mohave* *Navajo* *Pima* *Pinal* *Santa Cruz* *Yavapai* *Yuma* *Unknown*

INPATIENT DISCHARGES BY INTENT & MECHANISM FOR SELECTED EXTERNAL CAUSES BY COUNTY OF RESIDENCE IN ARIZONA

2010	399	1	0	1	3	4	0	4	269	28	0	36	33	0	5	15	0
2009	338	1	2	1	3	1	1	2	222	15	3	38	31	0	1	15	2

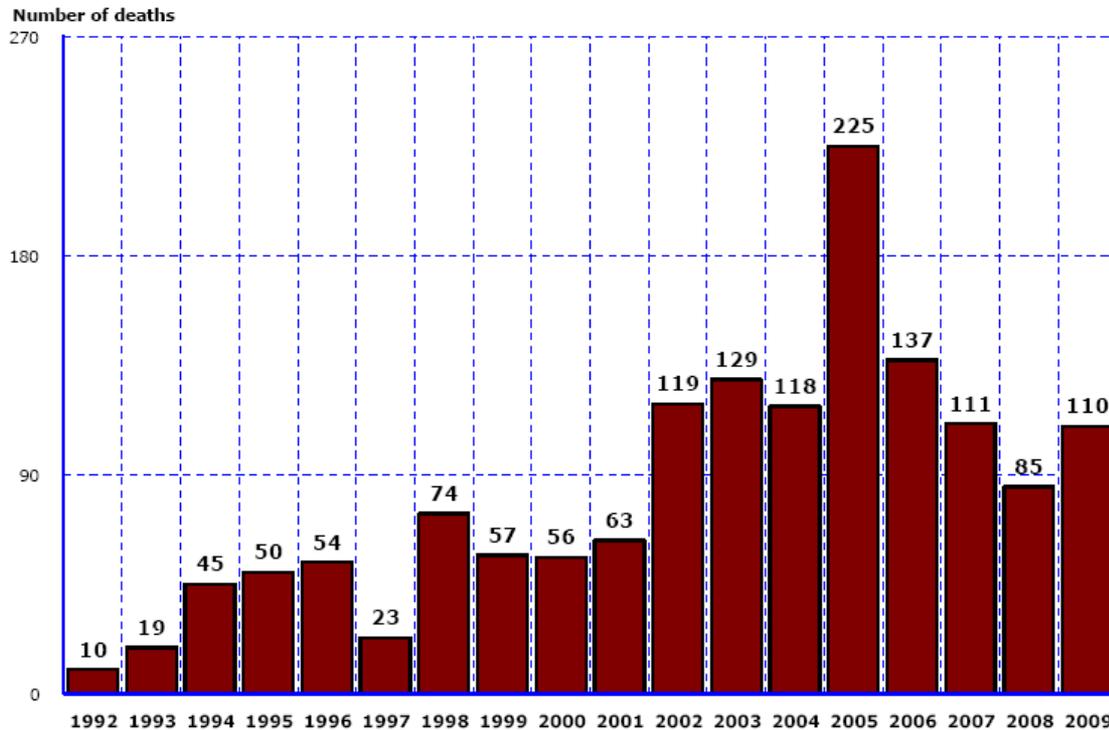
EMERGENCY ROOM VISITS BY INTENT AND MECHANISM OF EXTERNAL CAUSES & COUNTY OF RESIDENCE IN ARIZONA

2010	1,493	3	18	18	6	8	1	7	920	113	5	166	94	2	22	109	1
2009	1,319	2	11	10	4	4	0	9	809	80	3	143	95	0	19	129	1

(ADHS Bureau of Public Health Statistics, 2012)

Heat Illness Mortality

Figure 1
DEATHS FROM EXPOSURE TO EXCESSIVE NATURAL HEAT*
OCCURRING IN ARIZONA BY YEAR, 1992-2009

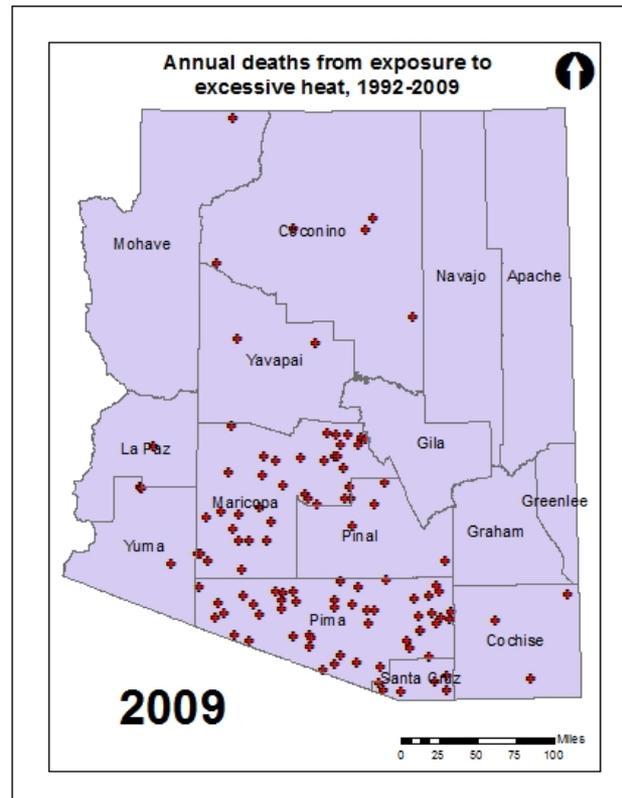


*The underlying cause of death was classified as E900.0 by ICD-9 (1992-1999) or as X30 by ICD-10 (beginning in 2000). Included are deaths occurring in Arizona from excessive heat due to weather conditions as the cause of heatstroke or sunstroke among both residents of Arizona and non-residents. Excluded are deaths due to excessive heat of man-made origin.

- 1,485 Deaths from (1992-2009)
- 225 Deaths in 2005
- 73.4% of Deaths were Male
- 54.6% of Deaths were Hispanic/Latino

(Mrela & Torres, 2010)

Heat-Related Deaths By County Time Series Map (1992-2009)



Health Effects of Climate Change

- **Direct consequences**

- *Heat-related mortality and hospitalizations.*
- *Injuries (e.g., due to hurricanes, tornadoes and fires).*
- *Displacement of populations (coastal flooding, desertification).*

- **Indirect consequences**

- *Changes in the incidence and distribution of infectious diseases.*
- *More complex causal pathways: enhanced infectious disease transmission due to displacement of populations.*

Potential Health Effects of Climate Change

Climate Change:

- **Temperature rise**
- **Sea level rise**
- **Hydrologic extremes**



HEAT

SEVERE WEATHER

AIR POLLUTION

ALLERGIES

VECTOR-BORNE DISEASES

WATER-BORNE DISEASES

WATER AND FOOD SUPPLY

MENTAL HEALTH

ENVIRONMENTAL REFUGEES



Heat stress, cardiovascular failure



Injuries, fatalities



Asthma, cardiovascular disease



Respiratory allergies, poison ivy



Malaria, dengue, encephalitis, hantavirus, Rift Valley fever



Cholera, cryptosporidiosis, campylobacter, leptospirosis



Malnutrition, diarrhea, harmful algal blooms



Anxiety, despair, depression, post-traumatic stress



Forced migration, civil conflict

Vulnerability and Climate Change



Climate-Sensitive Health Outcomes and Particularly Vulnerable Groups

Health Outcome

Vulnerable Groups

Heat Stress

Elderly, chronic medical conditions, infants and children, pregnant women, urban and rural poor, outdoor workers

Air Pollution Effects

Children, pre-existing heart or lung disease, diabetes, athletes, outdoor workers

Extreme Weather Events

Poor, pregnant women, chronic medical conditions, mobility and cognitive constraints

Water- and Foodborne Illness

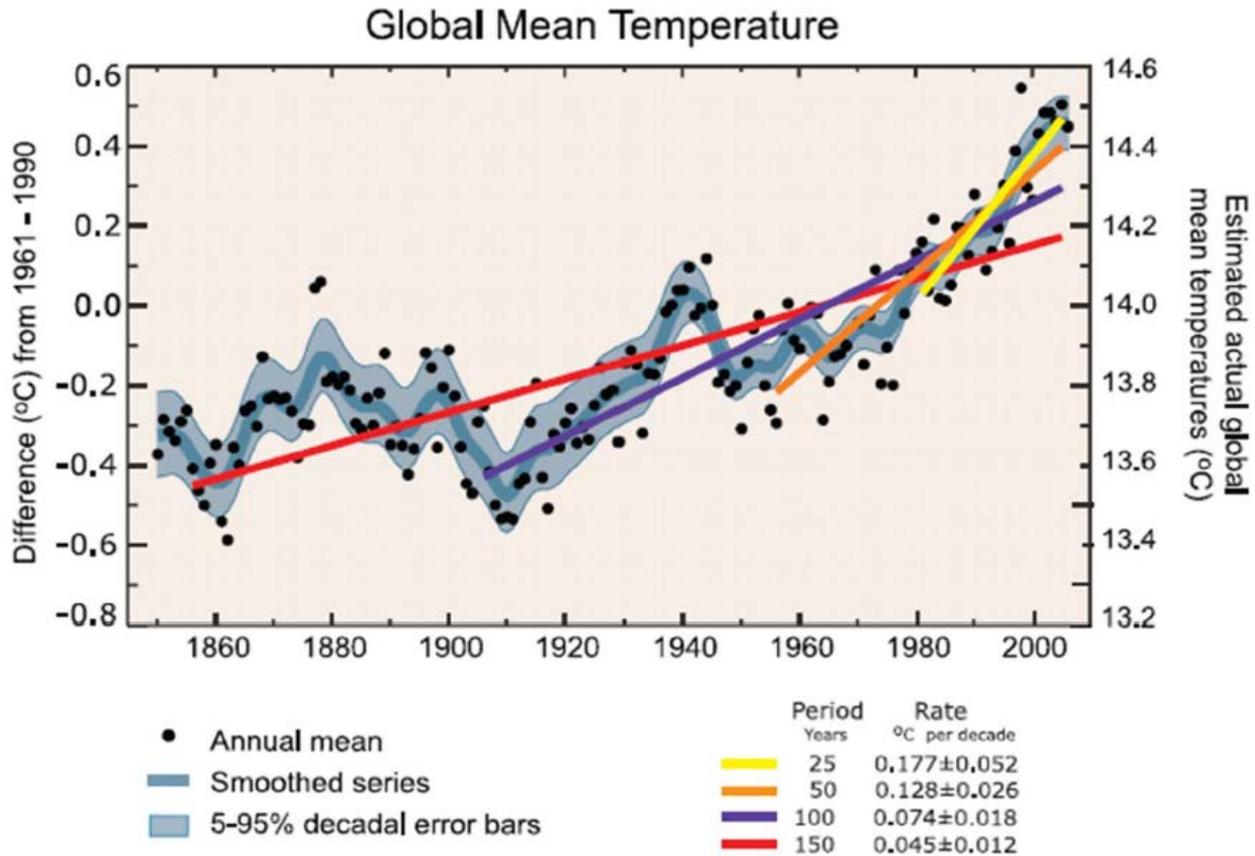
Immunocompromised, elderly, infants;

Vectorborne Illness

Children, pregnant women, outdoor workers

(Fisman, 2012)

Rising Temperatures



(Fisman, 2012)

Potential Impacts on Infectious Disease

- **Vector-borne disease:** changing ecosystems, ranges of amplifying hosts and insect vectors.
- **Diseases with environmental reservoirs:** Effects on food, water sources; “innoculation” via extreme weather events (e.g., melioidosis).
- **Communicable diseases (esp. respiratory pathogens):** perturbations of seasonal patterns of transmission (environmental change); mass movement and crowding of populations via social disruption.



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Water and Foodborne Diseases

- An important source of morbidity in North America
- Viral, bacterial and protozoan agents of gastroenteritis (e.g. *Salmonella* and *Shigella* species and toxinelaborating *E-coli*).
- Marked summertime (bacterial and protozoan pathogens)



Image from Microsoft Clip Art

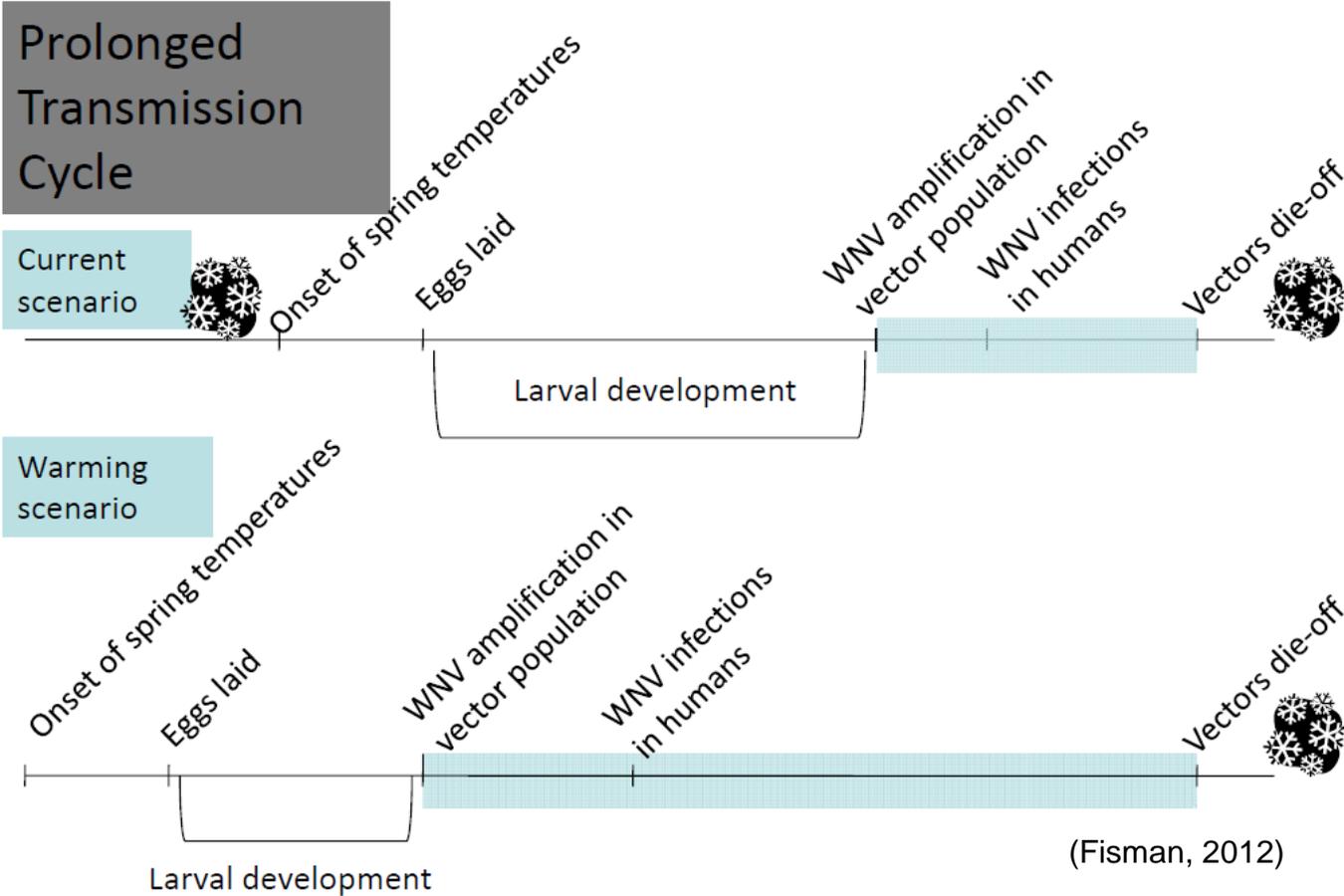
Infectious Disease Pattern in Arizona

	2011	2010	5 year median (2006-2010)
West Nile Virus	69	166	113
Hantavirus	3	0	1
Campylobacteriosis	933	954	940
Legionellosis	46	65	40
Coccidioidomycosis (Valley Fever)	16,472	11,884	5,535

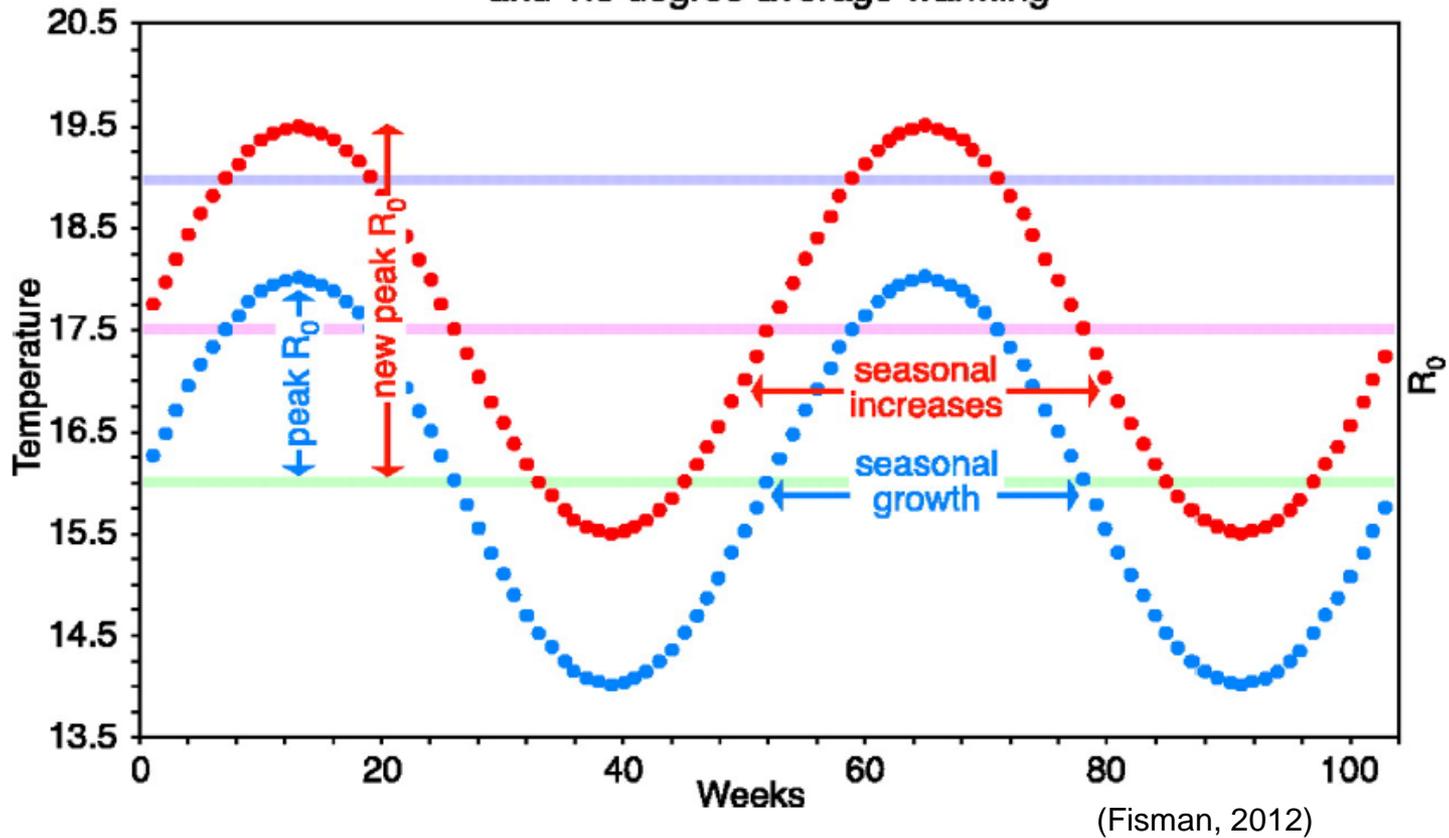
*No Lyme Disease Has Been Detected

(ADHS, 2012)

Prolonged Transmission Cycle



Response of pathogen growth rate to annual temperature and 1.5 degree average warming



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