GEO HEALTH Community of Practice
Annual Meeting 2021 – Day 2
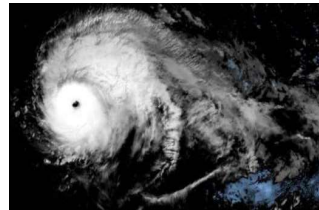
HEALTH CARE INFRASTRUCTURE –
The impact of **acute** extremes.

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John Balbus, NIEHS/NIH

Are these rare extremes?

- Earthquakes, floods, atmospheric events (e.g. Kentucky Berkshire) landslides are regular natural extremes with significant effects on population.

- Man-made caused toxic releases and radioactive accidents are rare, but with large population exposures.

- These are "**time** depending events" with heath emergencies for which the status and operational capabilities of HCF is important (**critical infrastructure**).

- Epidemics (and the ongoing pandemic) are causing escalating demands for hospitalizations that can raise acute needs beyond the normal capabilities.

# GEO Earth Observations for Health (EO4HEALTH 2020-2022)

Goals for this Area:
E. Health Care Facility Infrastructure and Status

1. Develop a partnership with UN agencies (WHO, UNISDR, UNEP) and governmental agencies (Australia, Canada, China, European Union, India, United Kingdom, United States) that share an interest in better identifying health care facilities at risk from environmental stressors and extreme weather events.

2. Integrate EO datasets (existing in open and possibly commercial sources) in order to develop an informational resource that assesses the vulnerability of health care facilities,

3. To assess their infrastructures **risks to local environmental stressors** (during seasonal loads and local population needs).

4. Develop methods to assess the adequacy of these facilities under regional acute catastrophes or during escalating chronic pandemics.

5. This has implications of their functional status both real-time operations and for long-term health adaptation planning.

Slide 2

Geolocation: Covid-19 Short-term Mortality Fluctuations

Data credit of: https://mpidr.shinyapps.io/stmortality/
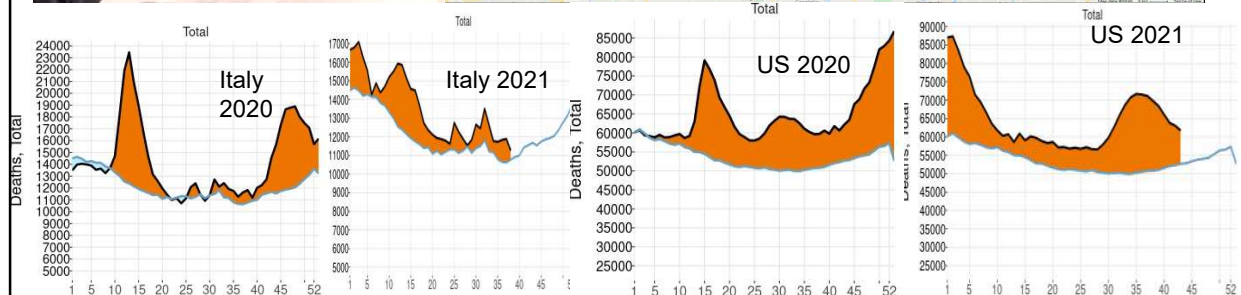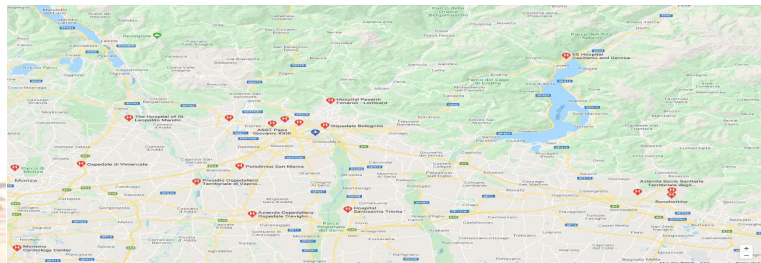
Particularly thankful to:

Earth Science Division
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Amos, Helen M.
[SCIENCE SYSTEMS AND APPLICATIONS INC];

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Munasinghe, Thilanka
[Rensselaer Polytechnic Institute],

Balbus, John [NIH/NIEHS]
[National Institute of Health] to the new …
Office of Climate Change and Health Equity
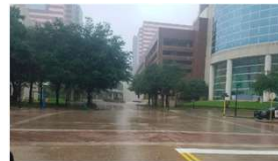within the Department of Health and Human Services.

Slide 5

Stories of Success: Healthcare Facility Resilience
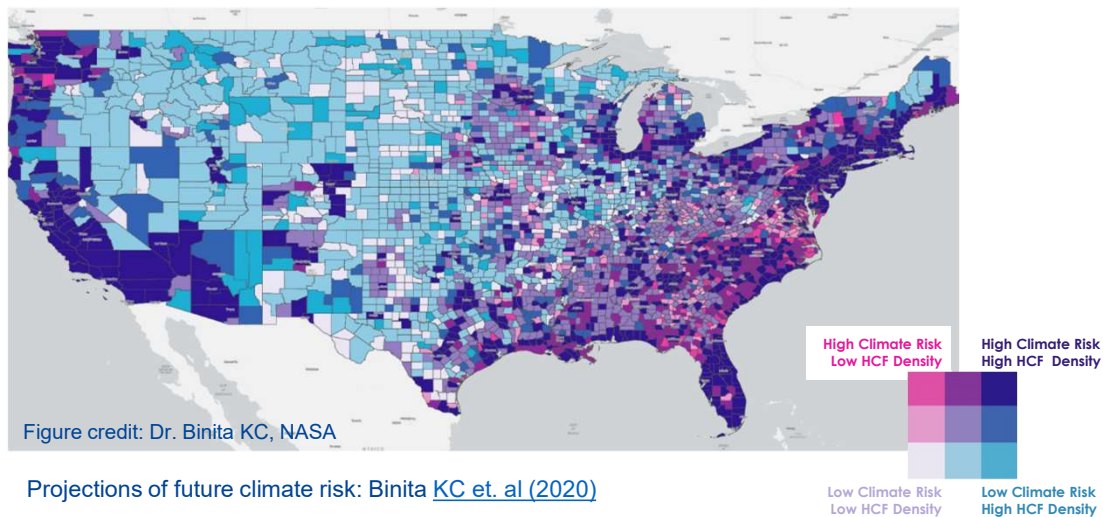## *Texas Medical Center in Houston, Texas*

Hurricane Harvey 2017

Tropical Storm Allison, 2001

Projected Future (2040s) Climate Risks for HCF

Figure credit: Dr. Binita KC, NASA

Projections of future climate risk: Binita KC et. al (2020)

High Climate Risk
Low HCF Density

High Climate Risk
High HCF Density

Low Climate Risk
Low HCF Density

Low Climate Risk
High HCF Density

The automation process …

Footprint of the residential structures,
Using deep learning models from the imagery,
Image segmentation and
…no trivial GPU or CPU capacity.

Big-data for efficient handling of emergencies

- Assessment of population health care capabilities associated with environmental exposure.

- Adequacy of their infrastructure status under usual and acute events.

- Testing of health infrastructure needs during emergency interventions.

- Coupled remote sensing with static ground observations for facilitating the real-time extraction processes.

  In the future integrate:

- Moving population densities (with e-passports) and

- Assessment and adaptation of health needs (intelligent with on-site technologies).

Current HCF (all levels) Italy:
In Italy 3816. In Lombardy 737 and in the counties:
• Milano 260;
• Brescia 77;
• Bergamo 76;
• Monza 63;
• Varese 57;
• Pavia 50;
• Mantova 49;
• Cremona 31;
• Como 30;
• Lecco 26;
• Lodi 10;
• Sondrio 8.

Some final remarks …

- 3d generation of handling data sources for "static" geo-located data (with pilot studies)/

- Describe the flow of data necessary for conducting the monitoring and assessment process.

- Covers the observations needed for assessing vulnerability of health care facilities and

- This process could identify the areas where additional humanitarian facilities will be necessary or the resources that could be borrowed from neighboring areas and

- Can assist in the optimization of relief capabilities during emergencies.

- Target to specific vulnerable population groups (child, elderly or …) and

- This is the starting work and the initial efforts for developing an operational collaboration for health-care resilience,