

HUMAN HEALTH, PUBLIC HEALTH PRACTICE AND COMMUNITY RESILIENCE

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Overview of presentation

- Conceptual issues: how does public health relate to resilience and to sustainability?
- What have we learned from the Gulf Oil Spill and from similar events?
- What health-related research can be done to achieve the strategic vision of the NAS Gulf Research Program?

Three Overlapping Phases in the Past, Present and Future of Environmental Management

- 1) Command and Control
- 2) Risk Assessment / Risk Management
- 3) Sustainability and Resilience

Resilience

- Resilient human communities anticipate risk, limit impacts, recover quickly and successfully adapt when faced with adverse events and change

Definitions of Health and Sustainability

- “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”
 - World Health Organization
- “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
 - Brundtland Commission of the United Nations, 1987

A Few Principles of Resilience

(After Joseph Fiksel – Ohio State University)

- Resilience is an intrinsic characteristic of all complex, self-organizing systems.
- A system is influenced by cycles of change at multiple temporal and spatial scales.
- Resilient systems respond to shocks or stresses by absorbing, adapting, or transforming.
- Resilient systems have feedback loops that help to maintain a dynamic equilibrium.
- A system may cross a threshold and shift to a different equilibrium state, or “regime”.

Resilience Concepts

- **Robustness:** the ability to withstand a given level of stress or demand without suffering loss of function.
- **Redundancy:** the extent to which systems are substitutable.
- **Resourcefulness:** capacity to identify problems, establish priorities, and mobilize resources when conditions exist that threaten to disrupt.
- **Rapidity:** the capacity to meet priorities and achieve goals in a timely manner in order to contain losses, recover functionality, and avoid future disruption.

Bruneau and Reinhorn. (2007). Exploring the concept of seismic resilience for acute care facilities. *Earthquake Spectra*, Volume 23, No. 1, pages 41-62.

SUSTAINABILITY VS RESILIENCY

Is the glass half full or half empty?

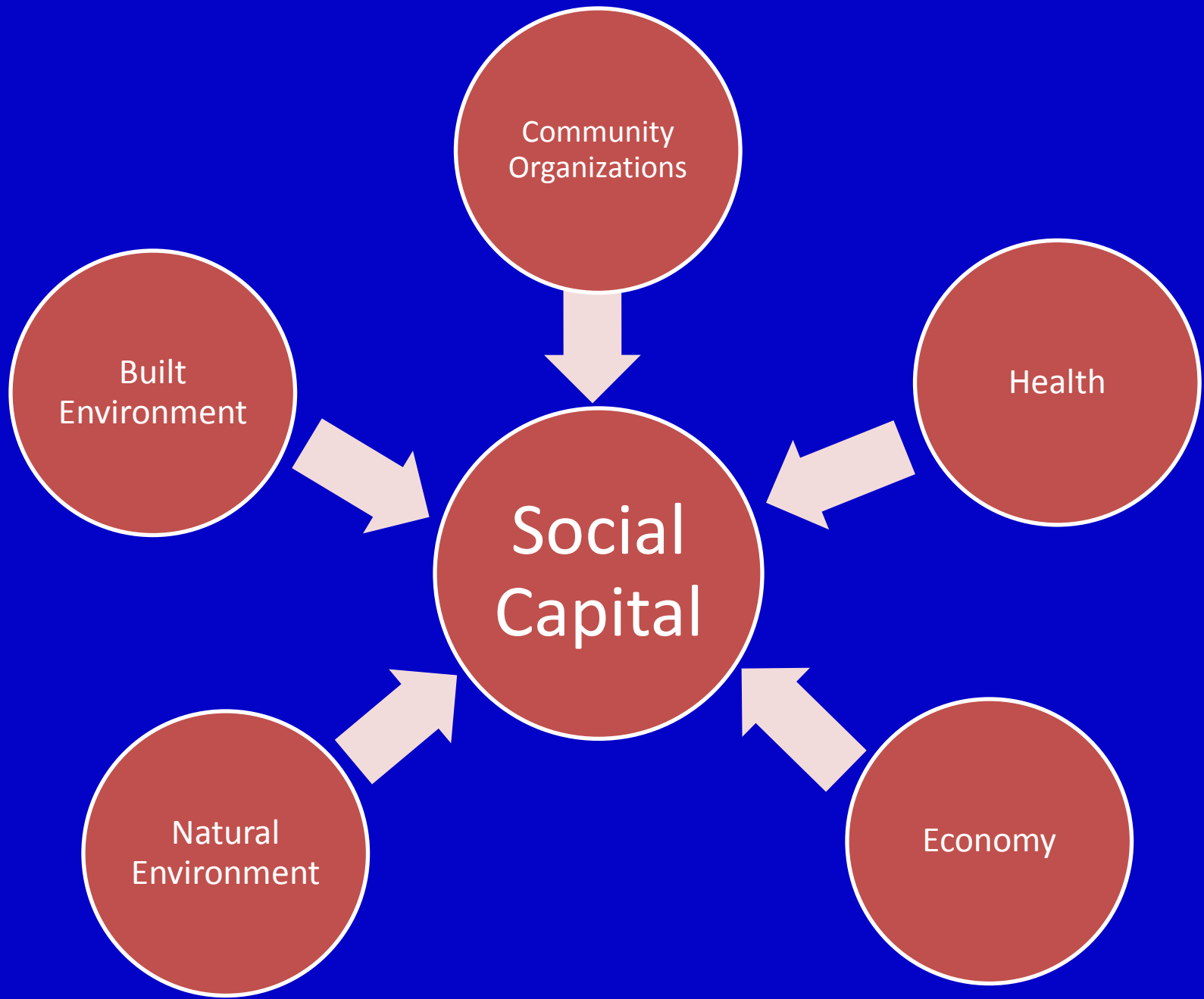
FOR SUSTAINABILITY: The glass is twice as large as it needs to be

FOR RESILIENCY: The glass needs to be larger than half size

BUT HOW MUCH LARGER?

Role of Resiliency in Sustainability

Sustainability Targets	Key Determinants	Trajectory
Adult Humans	Aging	Downhill (Death Inevitable)
Terrestrial Biomes	Human Activities	Downhill, but Potentially Reversible
Communities	Social Capital	Multi-Directional



CORE PUBLIC HEALTH DISCIPLINES AND THEIR COGNATE SCIENCES

- Behavioral and Community Health Sciences: *Psychology/Sociology*
- Biostatistics: *Statistics*
- Environmental Health: *Environmental Sciences/Engineering*
- Epidemiology: *Medicine*
- Health Care Policy and Management: *Economics/Political Science*

How Important is Understanding the Relation Between Public Health; Prevention; Resilience and Sustainability?

- Definitions are important if they have an impact on actions.
 - Planning is the mediator between definitions and actions
 - Definitions impact on both the geographical and the temporal dimensions of planning for oil spills

- Some sources of variability/change for which increasing resilience can mitigate adverse effects are not controllable at the source by humans (e.g., sunspots, hurricanes, earthquakes).

But others are (e.g., oil spills)

- In public health speak: an incident is not an accident



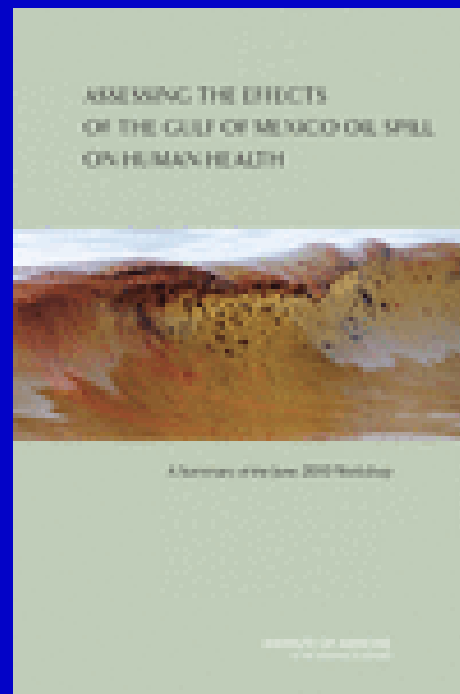


Gulf State Health Indicator Rankings

	Poor or fair health	Low birthweight	Adult smoking	Adult obesity	Uninsured
Alabama	47	48	43	49	29
Florida	31	36	27	18	49
Louisiana	46	49	40	49	41
Mississippi	50	50	47	50	44

Assessing the Effects of the Gulf of Mexico Oil Spill on Human Health – IOM Workshop Summary

Workshop held: June 22-23, 2010



IOM Report: Assessing the Human Health Effects of the Gulf Oil Spill

Margaret McCoy and Judith Salernoi

- Take home points
 - The Deepwater Horizon represents a failure of safety culture
 - Exposure assessment is central to linking chemical toxicity and effect
 - Psychosocial impacts may predominate
 - Lack of trust or transparency has psychosocial impacts
 - Risk communication must be tailored to community understanding
 - Seafood safety is a central short term and long term issue

Assessing the Human Health Effects of the Gulf Oil Spill

Margaret McCoy and Judith Salerno

“In addition to the physical stressors, the Deepwater Horizon oil disaster has disrupted delicate social, economic, and psychological balances in communities across the Gulf region. Local fishermen and –women . . . are grappling with possibly permanent disruptions to their long-standing livelihoods.... Communities question the safety of their most vulnerable populations and worry about the effects that the Gulf oil disaster will have on their immediate and long-term health. ***The resulting uncertainty about physical, social, and economic health has profound implications for the psychological well-being of individuals in affected communities.***”

(emphasis added)

COREXIT 9500 MSDS: NALCO

(edited)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous:

<u>Hazardous Substance(s)</u>	<u>(w/w)</u>
- Distillates, petroleum, hydrotreated light	10.0 - 30.0%
- Propylene Glycol	1.0 - 5.0%
- Organic sulfonic acid salt (Proprietary)	10.0 - 30.0%

Top 6 stressors in PA residents who believe their health has been affected by shale gas activities.

Stressor	Session 1 (n=33)
Denied or provided false information	79%
Corruption	61%
Concerns/complaints ignored	58%
Being taken advantage of	52%
Financial damages	45%
Noise pollution	45%

Ferrar, K. J., Kriesky, J. K., Christen, C. L., Marshall, L. P., Malone, S. L., Sharma, R. K., Michanowicz, D. R., Goldstein, B. D., (2013). Assessment and longitudinal analysis of health impacts and stressors perceived to result from unconventional shale gas development in the Marcellus Shale region. *International Journal of Occupational and Environmental Health*.

Social Amplification of Risk

- Major Determinants
 - Familiarity
 - Trust

“Boomtown” Effects Secondary to Cleanup Activities

Boomtown effects are due to sudden influx of young males earning money. They include sudden increases in:

- Alcoholism and drug abuse
- Traffic incidents
- Violence
- Sexually transmitted diseases

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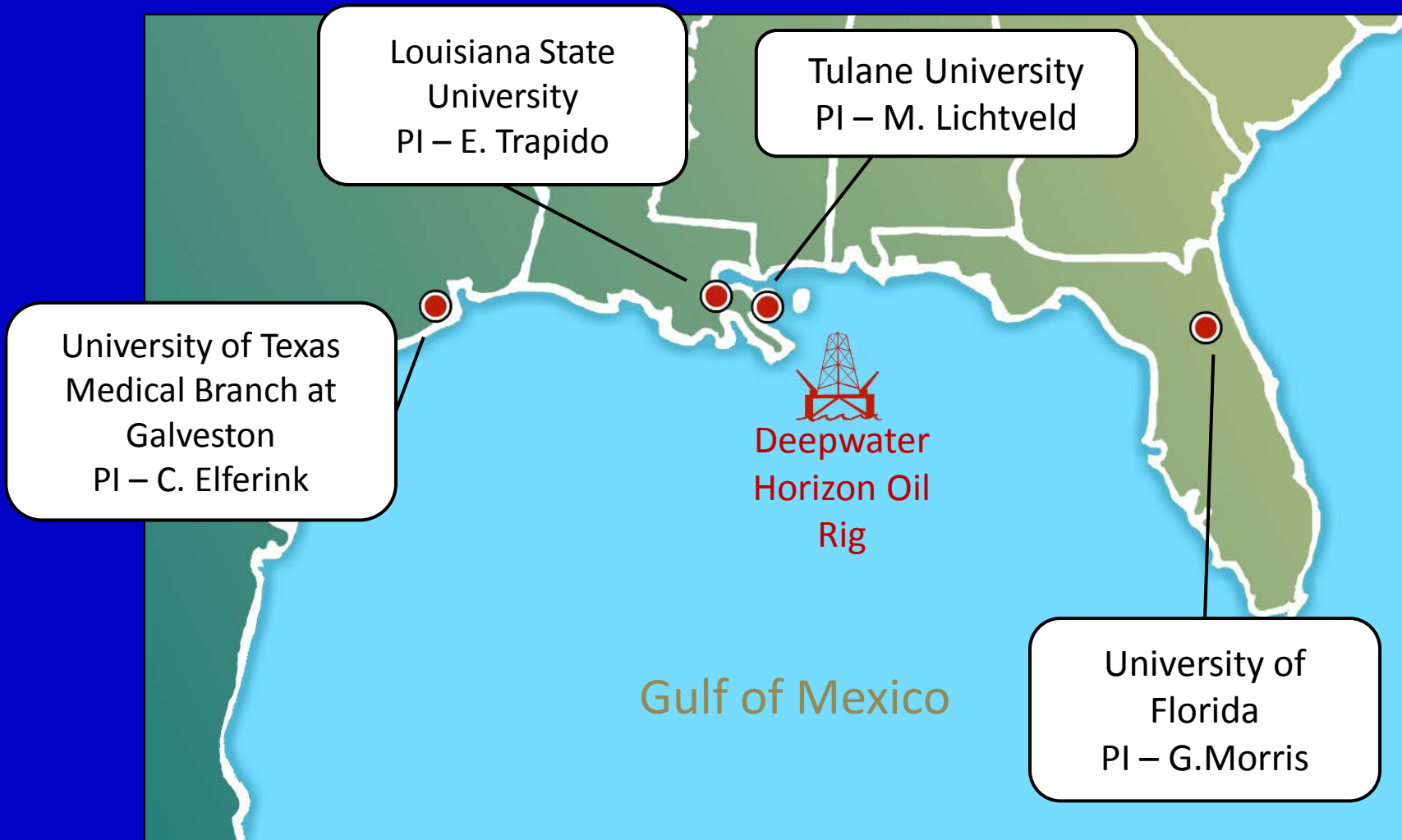
In response to “Boomtown” effects, New Orleans is arguably the most resilient city in the United States

NIEHS GuLF STUDY Cohort

- Prospective study of nearly 33,000 adults involved in oil spill clean-up or support
 - Enrolled March 2011 to March 2013
 - Baseline interview on clean-up jobs, symptoms, health
 - Recruited from lists of ~150,000 workers and potential workers (controls)
 - 63,000 with usable contact information
 - Added “Make the Call” campaign



DWH Research Consortia Grantees



A transDisciplinary approach: Addressing a suite of physical, biological, and societal needs to effect change in population health and the environment



- Community engagement
- Environmental health sciences
- Disasters and NCDs
- Maternal and child health
- Psychosocial health
- Cultural anthropology
- Physiology- nutraceuticals



The NEW ENGLAND JOURNAL of MEDICINE

Research as a Part of Public Health Emergency Response

Nicole Lurie, M.D., M.S.P.H, Teri Manolio, M.D., Ph.D., Amy P. Patterson, M.D., Francis Collins, M.D., Ph.D., and Thomas Frieden, M.D., M.P.H.

N Engl J Med 2013; 368: 1251-1255 | March 28, 2013 | DOI: 10.1056/NEJMSb1209510

Deepwater Horizon Oil Spill

“Both federal agencies and nongovernmental entities developed and rapidly established a roster of exposed workers and conducted important research, ***but there was no uniform, systematic collection of baseline data through surveys and biospecimen archives.*** Ultimately, the National Institutes of Health (NIH) supported a longitudinal study of exposed workers, but data collection did not begin until nearly 10 months after the spill.”

(emphasis added)

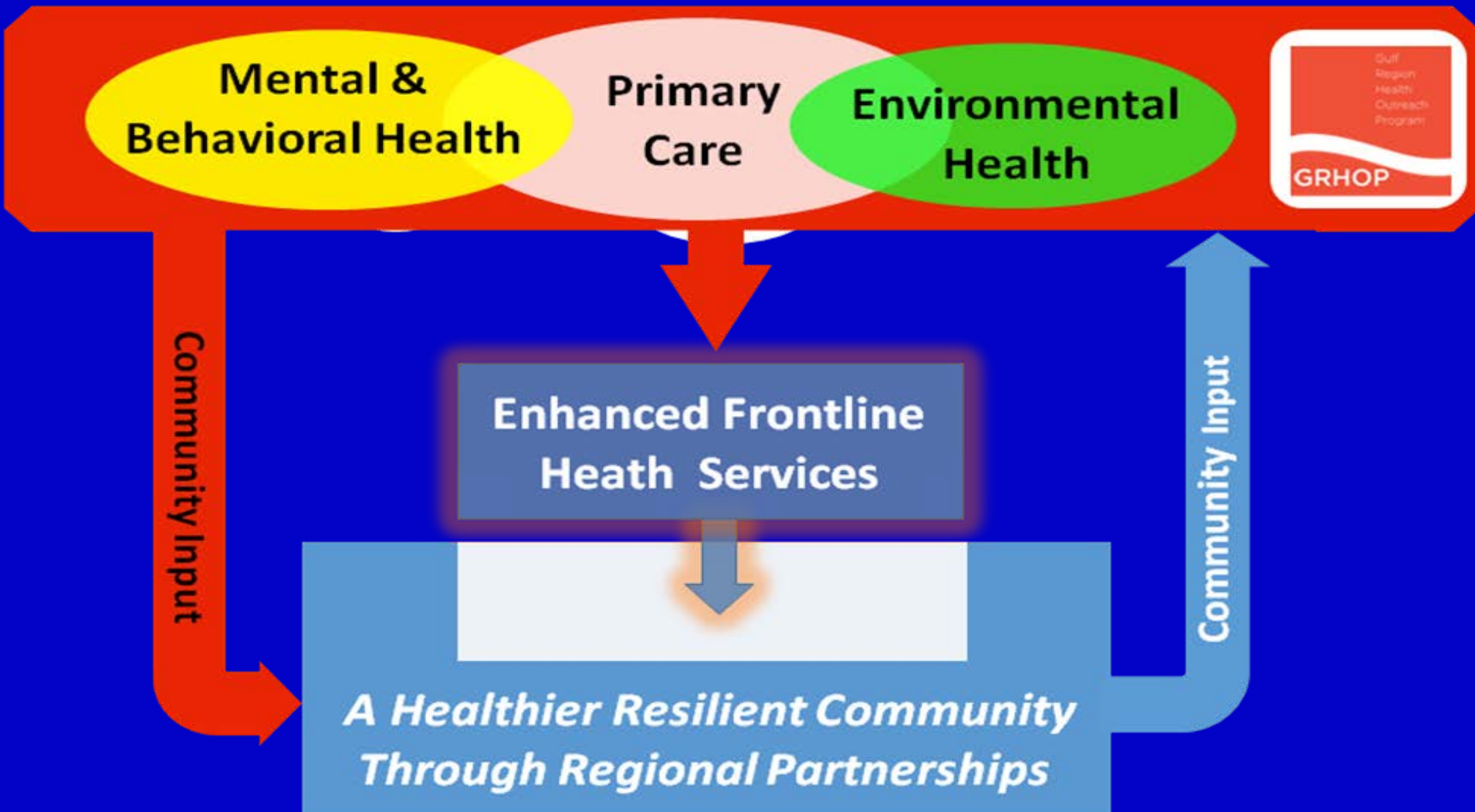


Gulf Region Health Outreach Program

(\$105 million/5 years)

Primary Care Capacity Project	Mental and Behavioral Health Capacity Project	Environmental Health Capacity and Literacy Project	Community Health Workers Training Project
<p>Louisiana Public Health Institute (Eric Baumgartner, Joseph Kimbrell)</p>	<p>University of Southern Mississippi (Timothy A. Rehner)</p> <p>University of South Alabama (Jennifer Langhinrichsen-Rohling)</p> <p>University of West Florida (Glenn E. Rohrer)</p> <p>Louisiana State University (Howard J. Osofsky)</p>	<p>Tulane University (Maureen Lichtveld)</p>	<p>University of South Alabama (J. Steven Picou)</p>
<p>Alliance Institute (Stephen Bradberry)</p>			

Gulf Region Health Outreach Program



Hebei Oil Spill; Korea; Dec. 2007

- **Reported substantial burden of disease attributable to oil spill**
- **In a population of 66,473 there were an estimated 14,724 disability-adjusted life years (DALY) lost one year after the spill**
- **Asthma and allergies greatest in females and those in their forties; mental health problems greatest in males and those in their twenties**

Kim Y-M et al; Burden of disease attributable to the Hebei Spirit oil spill in Taean, Korea; BMJ, 2013

Assessing the Human Health Effects of the Gulf Oil Spill

Margaret McCoy and Judith Salerno

- Take home points
 - Public Health surveillance is essential
 - Worker health and community health are linked
 - Vulnerable populations should be the focus
 - Communities must be involved in research planning and execution
 - Public health research and evaluation must be disaster-ready



The NEW ENGLAND JOURNAL of MEDICINE

Bernard Goldstein, M.D., Howard J. Osofsky, M.D., Ph.D., and Maureen Y. Lichtveld, M.D., M.P.H.

N Engl J Med; 364: 1334-1348 | April 7, 2011 | DOI: 10.1056/NEJMra1007197

- The literature is inadequate to respond to the many questions asked by clinicians and the public about this spill or the risk of future spills
- Potential health consequences of oil spills fall into four categories:
 - worker safety;
 - toxicologic effects in workers, visitors, and community members;
 - mental health effects from social and economic disruption;
 - ecosystem effects that have consequences for human health.



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“Several initiatives are urgently needed, before similar disasters occur in the future: rapid development and implementation of protocols for baseline clinical evaluations, including respiratory function; biospecimen banking; short- and longer-term medical surveillance and monitoring of workers; and development of psychosocial interventions. . .especially for vulnerable populations.”

Research Needs Related to Pregnant Women

- What are the reproductive and developmental risks of exposure to crude oil, “weathered” crude oil, dispersants and mixtures?
- How do these compare with the risks of evacuating pregnant women from their community, including living elsewhere?
- Should pregnant women be advised against working on oil spill cleanups?

Requirements for Research on Determinants of Community Health Resilience Related to Response to Coastal Oil Spills

- Cross-cutting multidisciplinary approach
- Community cooperation and involvement
- Public health agency cooperation and involvement
- Longer term research support
- Interdependent projects
- Valid metrics of community resilience

Major Research Needs Related to the Temporality of Oil Spill Toxicology

- **Acute effects**: Little known about the acute human toxicology of “weathered” crude oil; of dispersants; of mixtures
- **Subacute effects**: Better answers needed to question of when is seafood safe for human consumption
- **Chronic effects**: Almost no studies of chronic toxicology of “weathered” crude oil to which exposure is likely to occur

Cumulative Risk Assessment

- Cumulative risk assessment was originally intended to integrate across all of the chemical risk factors to which an individual is exposed and through all of the pathways of exposure
- As such, it was seen as particularly relevant to environmental justice issues
- More recently, a large body of evidence has shown that lifestyle, social and behavioral factors moderate an individual's response to chemical exposures

Olden Hypothesis

- The epigenome can be used as a biosensor to monitor cumulative effects of exposure to multiple chemical and non-chemical stressors over the life course.

Both Chemical and Non-Chemical Stressors can Induce Epigenetic Changes in DNA and Chromatin

Non-Chemical

- Psychosocial Stress
- Famine
- Poverty
- Maternal grooming
- Exercise
- Noise
- Health care
- Nutritious food

Chemical

- Arsenic
- Cadmium
- Lead
- Methylmercury
- Motor vehicle emissions
- Cigarette smoke
- Bisphenol A
- Ozone
- Benzene
- DDT

Examples of Diseases/Disorders associated with Epigenetic Modifications include:

- Cancer
- Diabetes
- Cardiovascular disorders
- Neurodevelopmental disorders
- Mental health disorders
- Metabolic syndrome and obesity
- Asthma
- Autism

Five Elements of a Complete Exposure Pathway

- Sources of contaminants,
- Environmental media,
- Points of exposure,
- Routes of exposure,
- Receptor population

Language of the Executive Orders Creating Unconventional Natural Gas Drilling Advisory Committees

(Goldstein et al, Env Hlth Persp 120:483-486, 2012)

“...task the Secretary of Energy Advisory Board (SEAB) with establishing a subcommittee...to develop, within six months, consensus recommended advice to the agencies on practices for shale extraction **to ensure the protection of public health and the environment**” (emphasis added)

-President Barak Obama in
Blueprint for a Secure Energy Future (March 2011)

The Marcellus Shale Safe Drilling Initiative will assist State policymakers and regulators in determining how gas production from the Marcellus shale in Maryland can be accomplished **without unacceptable risks of adverse impacts to public health, safety, the environment and natural resources**” (emphasis added)

-Maryland Governor Martin O’Malley in
Executive Order 01.01.2011.11: The Marcellus Shale Safe Drilling Initiative (June 2011)

“WHEREAS, the Commonwealth takes seriously its responsibility to ensure the development of natural gas in a manner that **protects the environment and safeguards the health and welfare of its citizens**” (emphasis added)

-Pennsylvania Governor Tom Corbett in
Executive Order 2011-011: Creation of Governor’s Marcellus Shale Advisory Commission (March 2011)

Science in support of the *Deepwater Horizon* response

Jane Lubchenco^{a,1}, Marcia K. McNutt^b, Gabrielle Dreyfus^{a,2}, Steven A. Murawski^{a,3}, David M. Kennedy^a, Paul T. Anastas^{c,4}, Steven Chu^d, and Tom Hunter^{e,5}

^aNational Oceanic and Atmospheric Administration (NOAA), Department of Commerce, Washington, DC 20230; ^bUS Geological Survey, Department of the Interior, Reston, VA 20192; ^cOffice of Research and Development, US Environmental Protection Agency, Washington, DC 20460; ^dUS Department of Energy, Washington, DC 20585; and ^eSandia National Laboratory, Albuquerque, NM 87111

Applications of science and engineering to quantify and control the *Deepwater Horizon* oil spill

Marcia K. McNutt^{a,1}, Steven Chu^b, Jane Lubchenco^c, Tom Hunter^{d,2}, Gabrielle Dreyfus^{c,3}, Steven A. Murawski^{c,4}, and David M. Kennedy^c

^aUS Geological Survey, Department of the Interior, Reston, VA 20192; ^bUS Department of Energy, Washington, DC 20585; ^cNational Oceanic and Atmospheric Administration (NOAA), Department of Commerce, Washington, DC 20230; and ^dSandia National Laboratories, Albuquerque, NM 87111