



**Implementing the New “Germ” Theory for the Public’s
Health: A Call to Action**

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PREFACE

We believe that America is facing a public health crisis of major proportions. The health of our citizens, our economic productivity, the stability of our institutions, and our global leadership are all being undermined by social conditions creating toxic levels of stress, which in turn interact with biological vulnerabilities to affect both individuals and communities.

Our failure to address these social conditions or to help people and communities become more resilient is primarily a failure of political will. The scientific basis for understanding the “epidemics” of today is largely established. We already know how to develop and implement effective prevention and intervention technologies that could help to remedy the current situation. What we lack is sufficient public awareness that solutions exist and sufficient public outrage to demand a comprehensive national and local response.

In this paper, we review troubling health and social indicators that should be cause for widespread concern. We look at epidemiological and neurobiological research on the connection between toxic stress and a wide range of health and social problems, and we consider the role of risk and protective factors in building resilience. We review evidence that effective intervention technologies exist, present a framework for a public health approach to treatment and prevention, and outline a political action strategy.

Throughout the paper, we frame the current public health crisis using the metaphor of the “germ theory” and the public hygiene movement in the late 19th and early 20th centuries. We are not implying that there is a single “germ” causing all our social ills just as there was no single germ causing infectious illnesses. Rather, we want people to recognize that a public health approach is essential in addressing these issues. The public health crusaders who identified the underlying causes of the contagious epidemics of the 19th century changed our understanding of these diseases and instigated a radical shift in our collective response to health crises. They developed community infrastructure in the forms of water and sewer systems, passed vaccination laws, promoted decent housing and safe food standards, developed community education programs, and advocated for the availability of antibiotic treatments. Together, these efforts largely eliminated the threat of infectious disease in developed nations. Focusing on the underlying causes of today’s social and behavioral health problems and developing the infrastructure to address them has the potential to inspire a similar revolution.

Public health revolutions often begin when careful scientific observations in the lab and in the field overturn current assumptions about the causes of a disease or condition. The germ theory replaced the prevailing belief that diseases were caused by “miasmas,” odors associated with poor sanitation that were thought to be disease-producing. A few decades later, the germ theory had become so well established that public health crusaders had enormous difficulty convincing the medical establishment that pellagra was caused by a dietary deficiency. In this paper, we use the germ theory metaphor to suggest that our response to the social and behavioral health epidemics of today has not caught up with our understanding of their causes.

In public health, theories and interventions rarely replace old ones suddenly or completely. Rather, they evolve slowly, and build on constantly changing knowledge and beliefs. By the time the germ theory was established, “sanitarians” had already made significant progress in cleaning up filthy neighborhoods and building new infrastructure. In the early 20th century, progress towards controlling pellagra through dietary supplements preceded identification of the specific nutritional component involved. Interventions to improve the public’s health in the 19th and 20th centuries did not wait for the final page of the scientific story to be written. Rather, laws were passed, efforts to contain and prevent illness were implemented, and new public hygiene measures provided testing grounds for further scientific observations. We believe that in a similar manner, we are poised today to make significant “social infrastructure” improvements that could improve our public health. Further refinements will emerge as our knowledge base grows.

Effective public health work rests on a clear understanding of the connections among politics, economics, culture and disease. In this paper, we examine some of the political battles that were fought in the public health revolution ushered in by the germ theory, and we speculate about how similar barriers may arise as society moves to address the epidemics of today. While a complete public health analysis lies well beyond the scope of this paper – and the expertise of its authors – we hope that this paper will play a role in stimulating such a discussion.

There are limitations to the germ theory metaphor. It may oversimplify a very complex set of issues, leading people to look for a “silver bullet.” It may focus our attention too much on biology, confound infectious and chronic disease models, or underplay the importance of local variability. Nonetheless, we think this metaphor is useful because it looks to the strength of current science and the public health interventions necessary to reap its benefits. It focuses on biological and environmental factors that we can address much as we addressed the problems of clean water and safe food. It gets people’s attention, tells a compelling story, and most importantly, points out that *change is possible*.

Our hope is that this paper will inspire people to move into action – in whatever way they can. We need a large-scale, national public movement to demand political action to address these issues, and we need it *now*.

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SECTION I. THE PUBLIC HEALTH REVOLUTION

In the mid 1800's, approximately 100,000 people died in the United Kingdom as a result of a cholera epidemic. The industrial revolution had led to increased urbanization, and in 1842, the average life expectancy for male industrial workers was fifteen.¹ Death rates in urban centers were twice as high as those in rural settings. Clearly the effects of early urbanization and industrialization were devastating to health.

While many suspected that these horrible public health outcomes were related to sanitation, no compelling scientific model was available to explain how poor sanitation caused illness. In 1854, in the midst of a cholera epidemic, John Snow suspected that water was somehow involved. The story is now apocryphal: Following a careful epidemiological study of the distribution of cholera cases, Snow concluded that the water supply on Broad Street was involved in the infections. He removed the handle from the water pump and the outbreak ended.² Despite this dramatic outcome, Snow's theory remained unproven for thirty years, until Louis Pasteur developed the germ theory of disease and Robert Koch identified the cholera bacillus as the infectious agent. Koch's discovery - coupled with Snow's practical findings and Pasteur's general theory - changed everything. Public hygiene measures were adopted to reduce exposure, and new techniques like vaccination and antibiotic treatments helped to control infection. With the emergence of effective public health technologies, demand for public hygiene measures had new force. Legislation was passed, standards were set, and new infrastructure was constructed to deliver clean water and safe food and to dispose of waste effectively. Over time, basic hygiene practices such as hand washing and sanitizing instruments became routine in medical care and in daily life. These public health measures resulted in the greatest reduction in disease and mortality in history. Today, citizens of developed nations take this public health infrastructure for granted, and public health measures are among the first goals adopted in developing countries. Yet for most people, public health infrastructure is invisible.

Today we have an epidemic of behavioral health disorders in the United States. The United States has the highest rates of mental illnesses in the world, according to World Health Organization (WHO) international epidemiological surveys.³ On many measures of our competitiveness and human capital we are progressively lagging behind other developed nations. We've dropped from 11th to 42nd in the world in longevity during the last twenty years.⁴ Clearly something is terribly wrong with our health.

Behavioral health disorders are not only the most disabling of all illnesses in the United States and throughout most of the world⁵, they are often the progenitors of other general health problems (e.g., inactivity and obesity, smoking and lung cancer, risky sexual behavior and HIV). While we struggle with these problems and attempt to implement various 'reform' efforts, no general theory of the etiology of behavioral health problems is yet widely accepted. Such a theory could guide a systemic approach to prevention and intervention.

We think that the data to support such a theory are largely developed. The theory involves the interaction of genetic vulnerability with toxic environmental stress to produce neural, endocrine and immune system changes that become the hallmarks of both behavioral health

disorders and a range of general health conditions that are undermining our health and well being. In the past three decades, we have learned much about how genetic factors contribute to health and illness and how chronic and toxic stressors contribute directly to behavioral health, health and social outcomes. We have learned about the protective factors that help people to overcome potentially damaging circumstances and how effective social policies and programs can reduce the likelihood of trauma. Much is now known about how to prevent several of the agents that cause individuals to become ill. These are the modern day ‘germs’ of behavioral health problems. Rigorous, long-term research now documents our ability to combat these agents and dramatically improve behavioral and general health. We are on the verge of the next great leap forward in public health.

In this paper we will sketch the features of this new general theory of health and illness. We will also outline a public health response to the current epidemic of behavioral health and social disorders. This is a call to action to mobilize the political will to demand that these public health interventions be universally available. The time to act is now. We have no time to waste.

SECTION II. THE EPIDEMICS OF TODAY

While infectious diseases have largely been brought under control in developed nations, it is clear that there are serious problems with our public health. Not only has life expectancy in the United States plummeted in comparison with other countries, so have a number of other health indicators. The U.S. infant mortality rate is higher than in most developed countries, and the gap is widening – the U.S. ranking fell from 12th in 1960 to 29th in 2004.⁶ The U.S. also ranks very low (24th) in comparison with other developed countries on “disability-adjusted life expectancy” – the number of healthy years that can be expected on average in a given population.⁷ Even more striking, there is huge variability in health status within the United States, and the single strongest predictor is income. Children living in poverty are seven times more likely to have poor health, compared with children living in high-income households.⁸ There is a 14.7 year difference in life expectancy between the longest- and shortest-lived counties in the United States, and that gap has widened by 60% in the past twenty years.⁹

The U.S. also leads the world in lifetime prevalence rates of behavioral health disorders. In a study of 17 countries in Africa, Asia, the Americas, Europe and the Middle East, WHO found that the U.S. had the highest prevalence rate of “any disorder” (47.4%), anxiety disorders (31%), mood disorders (21.4%), and impulse control disorders (25%). In the category of substance abuse disorders, the U.S. ranked second, with a lifetime prevalence rate of 14.6%, surpassed only by the Ukraine, with a rate of 15%.¹⁰

Many of our current health problems appear to be related to chronic conditions such as obesity, heart disease and diabetes. In a study of 27 countries where health examinations are routine, the U.S. has the highest rate of obesity (30.4%). Mexico is second with a rate of 24.2%; Japan and South Korea have the lowest rates (both at 3.2%).¹¹ In a comparison with five other nations (Australia, Canada, Germany, New Zealand, and the United Kingdom) the United States

ranked last on a measure of “healthy lives,” scoring poorly on all three indicators (mortality amenable to healthcare, infant mortality, and healthy life expectancy at age 60).¹²

Our society appears to be “sick” in other ways, as well. International crime rate comparisons are notoriously difficult to make due to differences in reporting, but firearm-related deaths and homicide among young males appear to be significantly higher in the U.S. than in other economically comparable countries. In one study, the rate of firearm-related deaths in the U.S. was eight times that of our economic counterparts.¹³ In another study, the U.S. homicide rate for males 15-24 years old was the highest of 22 developed countries, more than four times the rate of the next highest country, Scotland.¹⁴ We incarcerate people at a rate that is far higher than any other nation – 700/100,000 population compared to 110 for China, 80 for France, and 45 for Saudi Arabia. With a prison population of 2.3 million, we now have more people incarcerated than any other nation. In a study of relative poverty rates in 21 rich countries, the U.S. had the second highest poverty rate both overall and for children, surpassed only by Mexico.¹⁵ Research also suggests that mobility in and out of poverty is lower in the U.S. than in almost every other rich country. We currently have 46 million people living in poverty¹⁶, over a half million individuals are homeless on any given night¹⁷, over 50 million people and half of all children using food stamps¹⁸, almost 18% of children living below the poverty line, and at least 15 million people living in poverty despite having a job.¹⁹ America also has the greatest inequality of income and wealth in the industrialized world.²⁰

Our children’s educational performance is suffering. In 2007, U.S. students ranked 21st in science literacy²¹, 24th in problem-solving literacy²², and 25th in mathematics literacy²³ compared to the 30 OECD (Organization for Economic Co-Operation and Development) countries. Our educational status in comparison with the rest of the world is also decreasing: the U.S. ranking of postsecondary graduation rates fell from second in 1995 to 16th in 2005.²⁴

The health and social status of our workforce has profound effects on economic productivity and international competitiveness. Measured by time spent on the job, Americans are the most productive workers in the world – we now work an average of 200 hours per year more than workers in the other OECD countries, even more than the Japanese. Despite our long hours, the first decade of the 21st century was economically disastrous. Buchanan reports that, according to the International Monetary Fund, U.S. gross domestic product (GDP) as a percentage of world GDP dropped from 32% to 24% between 2,000 and 2010. No nation in modern history, save for the former Soviet Union, has seen so precipitous a decline in relative power in a single decade.²⁵

SECTION III. IS THERE A COMMON DENOMINATOR? THE EPIDEMIOLOGY

Is it possible that these broad health, social and economic changes in the U.S. are related in some way? It has long been accepted that social determinants affect the health and productivity of the population.²⁶ Social determinants are characteristics of the built or social-psychological environment that are productive of chronic stress and trauma and are clearly

associated with diminished health status and academic and occupational achievement. We will argue that the effects of these social determinants are mediated through individuals' reactions to the toxic stress associated with living in unpredictable environments, which in turn, can lead to neurological, hormonal, endocrine and immune system changes that underlie the development of behavioral and general health conditions. The development of these conditions compromises academic and, ultimately, occupational achievement. The deterioration of human capital, therefore, underlies the troublesome health and social indicators summarized earlier. Individual differences in vulnerability conferred either through heredity or skills training may interact with toxic stress or other environmental variables in determining an individual's response and the ultimate course of his/her development through life. We further argue that, based on this understanding of the effects of toxic stress, we have multiple interventions that can be used to either reduce the presence of risk factors and/or to strengthen individual or community resilience for weathering these effects.

Many of the social determinants discussed above are directly related to poverty. Public health is built on the recognition of epidemiological connections between poverty, the broader social and economic patterns causing it, and particular diseases.²⁷ The relationship between poverty and health, often referred to as the social gradient in health, is well established. In general, the wealthier you are, the healthier you will be and the longer you will live.²⁸ However, this relationship is mediated by numerous factors, and it is these factors that public health reformers seek to uncover. For example, although in the 18th and 19th centuries infectious diseases were associated with the poor, they were not confined to poor neighborhoods. Elaboration of the germ theory led to the identification of conditions associated with poverty that increased the likelihood of exposure to pathogens, and turned many public health scientists into advocates for change. Rudolph Virchow, for example, was sent to investigate an outbreak of cholera in Upper Silesia and quickly became a crusader for better employment and living conditions.²⁹ Similarly, although pellagra was so highly associated with poverty that Goldberger stated: "The problem of pellagra is in the main a problem of poverty," it was a specific diet associated with poverty – a diet particularly common among poor sharecroppers and mill workers in the rural south – that led to the condition. The behavioral health epidemics of today are no more "caused by" poverty than yellow fever, cholera, or pellagra were, but poverty clearly puts people at risk. The theory proposed in this paper suggests that it is high levels of toxic stress – often associated with but certainly not limited to the poor -- that mediate the relationship between poverty and behavioral health and social problems.

If toxic stress is the mediating factor between social conditions and poor health outcomes, we would expect toxic stress to have an impact regardless of income. In fact, an extensive epidemiological study convincingly demonstrates a strong relationship between the toxic stress of childhood trauma and poor behavioral and general health outcomes in a middle class population. The Adverse Childhood Experiences (ACE) Study³⁰ is a retrospective and prospective analysis of the relationship between traumatic stress in childhood and the leading causes of morbidity, mortality and disability in the United States, including chronic medical diseases, mental illness, obesity, and substance abuse. A collaborative effort between Kaiser Permanente's Department of Preventive Medicine in San Diego and the Centers for Disease

Control (CDC), the study includes over 17,000 individuals. Subjects are middle-class Americans with health insurance: Eighty percent are white (including Hispanic), 10% black, and 10% Asian; half are men and half women; 74% have attended college; their average age at entry into the study was 57.

Subjects were asked whether or not they had experienced any of eight ACE categories in the first wave of the study; two categories of neglect were added in the second wave. The ACE categories are shown in the following chart,³¹ along with their overall prevalence rates:

ACE Category	Definition	Prevalence
Emotional abuse	Recurrent threats, humiliation	11%
Physical abuse	Beating, not spanking	28%
Sexual abuse	Contact abuse only	22%
Domestic violence	Mother treated violently	13%
Substance abuse	Alcoholic or drug user in household	27%
Incarceration	Household member imprisoned	6%
Mental illness	Household member chronically depressed, suicidal, mentally ill or in psychiatric hospital	17%
Parental separation	Not raised by both biological parents	23%
Physical neglect	Lack of adequate food, shelter, physical support	10%
Emotional neglect	Family failed to provide a source of strength, emotional support, and protection	15%

The individual's ACE score is calculated by a count of the number of categories that had occurred during their first 18 years of life. Multiple occurrences are not recorded, making this a conservative measure. ACE scores are then matched with the individual's current state of health and well-being and with various measures of health care utilization, cost, and death.

Only one-third of the population has an ACE score of zero. One in six has an ACE score of 4 or more; one in nine has a score of five or more. Women are 50% more likely than men to have an ACE score of five or more. ACEs do not occur randomly: If any one category is present, there is 87% likelihood that at least one additional category will be present. ACE categories are approximately equal in their impact.

There are strongly proportionate and significant relationships between ACE scores and a variety of mental health, health, behavioral and healthcare utilization measures, decades after the experience of adverse childhood events. Mental health indicators such as chronic depression, hallucinations, suicide attempts, and use of psychotropic medications are all strongly and significantly related to ACE scores, as are health risk behaviors such as smoking, alcohol use, IV drug use, and multiple sex partners. IV drug use is particularly striking - a male child with an ACE score of 6 or higher is 46 times more likely to be an injection drug user than a child with a

score of 0. Very strong relationships are also reported between ACE scores and a host of biomedical conditions, including liver disease, autoimmune disease, chronic obstructive pulmonary disease and coronary artery disease – even after controlling for conventional risk factors such as smoking. Healthcare utilization, costs, and life expectancy are also strongly related to ACE scores. After 14 years of prospective research, the study finds that people with an ACE score of 6 or higher die almost 20 years earlier than those with an ACE score of 0, even with otherwise similar characteristics.

The ACE study focuses on adverse events that occur before the age of 18, and there is substantial evidence that abuse occurring early in life has more profound impacts than trauma

Traumatic Event	Lifetime Prevalence of Trauma	
	Men (n=2,812)	Women (n=3,065)
	%	%
Rape	0.7	9.2
Molestation	2.8	12.3
Physical attack	11.1	6.9
Combat	6.4	0.0
Shock	11.4	12.4
Threat w/ weapon	19.0	6.8
Accident	25.0	13.8
Natural disaster	18.9	15.2
Witness	35.6	14.5
Neglect	2.1	3.4
Physical abuse	3.2	4.8
Other trauma	2.2	2.7
Any trauma	60.7	51.2
<i>Note: Adapted from Kessler et al (1995).</i>		

during adulthood. Young children lack a stable sense of self that can help moderate the impact of extreme events, and toxic stress has a direct impact on biological and neurological development.³² However, acute and chronic stress in adulthood can also have profound consequences. As the chart at the left shows, over 60% of men and 50% of women experience significant trauma at some point in their lifetime.³³

Lifetime experience of acute and chronic stressors has a direct impact on service utilization. According to most estimates, trauma is an almost universal experience among people who use public mental health, substance abuse and social services, as well as people who are justice-involved or homeless.³⁴ While rates of trauma vary depending on specific definitions and research design, it is estimated that as many as 90 % of people in psychiatric hospitals and 92 - 97% of homeless women have histories of physical or sexual abuse. Between 75 and 93 percent of youth entering the juvenile justice system have experienced some degree of trauma, and among males who experienced maltreatment prior to 12 years of age, 50-79 percent became involved in serious juvenile delinquency.³⁵ One study showed that men who

have witnessed their parents' domestic violence are three times more likely to abuse their own wives than children of non-violent parents, with the sons of the most violent parents being even more likely to abuse their wives.³⁶ Children who are exposed to violence often grow up to engage in or become victims of crime – a large percentage of both men and women in the criminal justice system have experienced trauma in childhood. Eighty percent of women in jails and prisons have been victims of sexual and physical abuse,³⁷ and in one study, all sixteen men

sentenced to the death penalty in California had histories of family violence, including thirteen cases of severe physical and/or sexual abuse while in foster care.³⁸

The medical and social costs of trauma and chronic stress are staggering. The cost of chronic illness goes far beyond the actual medical expenses. The direct cost of chronic illnesses in 2006 comprised 84% of overall health expenditures or well over 1.5 trillion dollars³⁹ Total cost to the economy of chronic illnesses is likely 4 times higher than the direct medical expense.⁴⁰ Although the full cost of violence and abuse to the health care system has not yet been estimated, a study using 2008 health care and population data show that the predicted incremental cost to health care system ranges between 17% and 37.5% of total health care expenditures.⁴¹

The epidemiological data reported in the ACE study suggest that there are two basic pathways through which the toxic stress of adverse childhood events affect public health. First, they increase conventional risk factors such as smoking, drinking, eating and engaging in risky sex. Second, chronic stress affects the developing brain and body and causes dysregulation of the stress response. Biomedical, behavioral and neuroscience research is now confirming this theory.

SECTION IV. THE IMPACT OF STRESS: NEUROBIOLOGY AND CAUSAL PATHWAYS

While John Snow's work on the Broad Street water pump was a dramatic event, the development of a systematic public health response to contagion required elaboration of the 'germ theory'. In the thirty years following his epidemiological studies, infectious agents were isolated and identified, modes of transmission were detailed, methods for blocking the infectious agents were developed and tested – including both treatment and prevention -- and anomalies in the theory were identified, studied and finally understood. As knowledge accumulated, replicable technologies for intervention were developed. As these elements fell into place, the modern system of public health emerged. The prevention and treatment of infectious diseases had a profound impact on the overall health of industrialized nations.

Our understanding of the antecedents of the behavioral health epidemic described earlier is much more refined than Snow's knowledge of bacteriology when he removed the pump handle. We have animal and human data that elaborate the relationships between genetic predisposition and environmental stressors in the development of illness. We have impressive data regarding the effectiveness of interventions to reduce or ameliorate the effects of risk factors. We have technologies informed by our knowledge of chronic stress and trauma that improve public health by reducing the level of stress and stimulating the development of resilience in individuals and communities. All of the knowledge for an effective, systematic public health response to the behavioral health epidemic is available. What we lack is general acknowledgement of this theory and a concrete plan of action to implement the next great wave in public health in communities across the nation.

Genetic Predisposition and Stress as Infectious Agents. While once extremely controversial, it is now nearly universally acknowledged that mental illnesses and substance use disorders have an important genetic component. Generally consistent with the scientific literature, heritability estimates for mental illnesses from one large twin study ranged from 0.16 for phobia to 0.66 for drug abuse or dependence.⁴² This means that from 16% to 66% of the differences between people in expression of illness can be attributed to genetics. Estimates for the heritability of schizophrenia are higher, approximately 0.80, indicating significant effects of genetics or genetically correlated effects.⁴³ However, the relationship between genetic risk and ultimate expression of an illness is not simple. As with most health conditions, genetic vulnerability and life experiences combine to produce the signs and symptoms of mental and addictive disorders. Addiction is probably the clearest example. As noted above, estimates of the heritability for drug abuse and dependence are relatively high – indicating an important genetic component for this disorder. If an individual never has contact with drugs, however, he or she will not become addicted. Similarly, we know from twin research that identical twins are concordant for schizophrenia more often than fraternal twins, indicating a substantial genetic component. However, the fact that identical twins are not always concordant for schizophrenia shows that causal factors other than genetics are also at work. Understanding environmental influences in the context of an individual’s genetic risk profile is therefore essential.

In combination with genetic vulnerability, we’ve come to understand that toxic stress is associated with the development of a wide range of disorders from mental illnesses to cardiac disease.⁴⁴ We now know from both animal and human research that chronic stress and trauma are associated with structural changes to the hippocampus, amygdala and pre-frontal cortex of the brain. Events that occur early in life have long-term effects on emotionality and stress responsiveness that can affect how people react to environmental challenges, predispose them to high risk behaviors, and increase the rate at which the brain and the body age.

Allostasis is the process of maintaining equilibrium in the face of threat. It involves the production of hormones (adrenal steroids) that provoke the flight or fight response. While clearly adaptive in the short term, prolonged exposure to these hormones is associated with neural and endocrine damage that can ultimately result in cognitive impairment, illness and death. Early experiences in life may prime the system to be overly responsive to environmental stress. Animal studies indicate that both pre- and post-natal stressors can have life-long impacts on the brain, causing hyper-reactivity, leading to prolonged exposure to cortisol and cytokines that damage neural structures, and ultimately affecting multiple areas of mental and general health as well as social functioning.⁴⁵ The brain, as the master controller of motor, affective, immunological and endocrine effects, likely encodes this damage and orchestrates its long-term effects

Trauma in adulthood also directly affects the brain. In neuroimaging studies, subjects with post traumatic stress disorder (PTSD) who are exposed to stimuli that remind them of earlier traumatic events show increased cerebral blood flow in the right medial orbitofrontal cortex, insula, amygdala, and anterior temporal pole, and a relative deactivation in the left anterior prefrontal cortex, specifically in Broca’s area, the expressive speech center in the brain. In

short, reminders of trauma activate areas of the brain that support intense emotions and decrease activity of brain structures involved in inhibiting emotions and translating experience into communicable language.⁴⁶ These findings have important implications for treatment.

Finally, although still ambiguous, data are becoming available that demonstrate the interaction of specific genes and environmental stress. Several investigators have demonstrated that individuals with a particular genotype respond differently to stress than individuals with an alternative gene composition. While replication of these studies is proving difficult, the combination of this genotype and stress seems to be associated with increased depressive symptoms.⁴⁷ Other research demonstrates that individuals with specific genetic fingerprints who are exposed to natural disaster and additional environmental stressors (unemployment and crime rates) are more likely to develop PTSD⁴⁸ than persons living in areas with less social disruption. Genetic expression itself is environmentally mediated. Epigenetics, an emerging subfield of genetics, refers to inherited changes in genetic expression that occur in response to environmental influences. Epigenetic research identifies issues in the expression of genes or in the replication of genetic material that seem to be associated with the development of mental illnesses. While much remains to be learned about the specific interaction of genes and environments in promoting health or predisposing illness, this early work is a step towards understanding how social events interact with genetic vulnerability and are differentially reflected in neuronal structures that may even be inherited across generations.

Resilience and Recovery from the Impact of Stress. If stress is a causal factor in behavioral health disorders, why doesn't *everyone* who is exposed to chronic and toxic stress exhibit symptoms of distress? In fact, people respond to potentially disturbing events in very different ways, and their responses can vary significantly over time and depending on context. While part of the answer to this question lies in differential genetic vulnerability, there is also evidence that environmental factors contribute to individual resilience and recovery.

Resilience refers to the capacity of individuals to maintain a relatively stable equilibrium and healthy levels of psychological and physical functioning after exposure to a potentially disruptive event.⁴⁹ Resilience has been demonstrated in both adults and children, and it appears to be common, at least after isolated traumatic events. Meta-analyses demonstrate that on average, only 20% of adults who experience severe traumatic stressors develop PTSD.⁵⁰ The percentage of individuals who develop other behavioral health problems depends on previous and subsequent traumatic events as well as other personal and contextual factors.

Many individuals who display severe reactions to acute or chronic stressors, either immediately or after a delay, recover to pre-trauma levels of functioning over time.⁵¹ The recovery process has been extensively studied since Judith Herman observed that many people move through stages of safety, remembrance and reconnection as they heal.⁵² A number of variables that affect recovery have also been identified. For example, trauma that is intentionally inflicted, especially by a trusted friend or relative, is often more profoundly disturbing than unintentional trauma, such as that caused by a natural disaster.⁵³ Recovery is most often studied in the

context of professional helping interventions, but there is growing evidence that recovery, like resilience, is a natural biological process.⁵⁴

Resilience and recovery have profound implications for how we as a society respond to toxic stress. Preventive and health promotion activities can produce resilient individuals who are better able to accommodate stress. Treatment is clearly an essential component of an overall response when appropriately timed to support natural growth-related processes.⁵⁵ How can we maximize resilience and self-healing while also responding effectively to those most severely affected?

Understanding risk and protective factors can help. In a review of 68 studies of PTSD, several risk factors were consistently found to increase the likelihood of developing PTSD, including: a previous traumatic event, previous psychological problems, family history of psychological problems, extent to which the traumatic event was life threatening, amount of perceived support after the event, emotional response at the time of the event, and dissociation at the time of the event. Dissociation, which is the experienced disconnection between thoughts, feelings and actions, was the strongest predictor of developing PTSD while prior history of personal or family psychological problems and previous trauma had the weakest association.⁵⁶

Protective factors – those associated with resilience and recovery – include the ability to cope with stress in a healthy manner, having good problem-solving skills, seeking help, believing that you are in control of your feelings, finding a support group, connections with family and friends, self-disclosure of trauma, feeling good about one’s own actions in the face of danger, spirituality, identifying as a survivor rather than a victim, helping others, finding positive meaning in the trauma, and being able to respond effectively despite feeling fear.^{57 58}

SECTION V. EFFECTIVE TECHNOLOGIES TO CONTAIN THE EXPRESSION OF BEHAVIORAL HEALTH PROBLEMS

Just as the movement to improve sanitation preceded acceptance of the germ theory, we have compelling reasons to implement our existing technology even though all of the mediating mechanisms in the development of mental health and substance use conditions are not fully understood. During the public hygiene revolution interventions were developed to:

- reduce community risk factors (e.g., draining swamps, building sewage systems, setting standards for safe food and water);
- strengthen community protective factors (e.g., building decent housing to reduce overcrowding, paving streets, improving wages, supplementing traditional diets);
- decrease individual exposure to pathogens (e.g., quarantines, improved medical practices including use of antiseptics, changing personal hygiene and sanitary practices);
- increase the capacity of individuals to resist infection (e.g., vaccinations); and
- contain infection through effective treatments (e.g., antibiotics).

With regard to the current epidemic of behavioral disorders, we have a considerable body of knowledge about interventions that work. Investment in a public health approach would likely result in the development and testing of additional tools and approaches.

Reducing Community Risk Factors. While the evidence base is limited, some effective strategies for reducing major sources of toxic stress have been identified. For example, WHO cites several programs that are effective in reducing the incidence of child maltreatment, and several others that are promising.⁵⁹ Effective programs focus on improving parenting skills and supports in populations with established risk factors for child maltreatment, including the failure of infant-parent bonding, unrealistic expectations about child development, a belief in the effectiveness of harsh physical punishment and an inability to provide quality child care when the parent is absent.

The most widely applied and evaluated child abuse prevention model is home visitation. A recent review of outcome studies showed that home visitation programs, on the average, reduced child maltreatment by parents and other family members by 40%.⁶⁰ The most successful programs focus on families in greater need of services, begin during pregnancy and continue until at least the second year of the child's life, are flexible in implementation, actively promote positive care giving behaviors, cover a broad range of issues specific to the family, include measures to reduce stress within the family and use nurses or trained semi-professionals.

Parenting education programs focus on the parents of children aged 3-12 years, use active teaching techniques, and promote positive reinforcement, non-violent discipline methods and negotiating and problem-solving strategies. They have been shown to be effective, although most evaluations have examined the impact on proximal outcomes such as parental competence and parent-child conflict rather than rates of maltreatment. However, a recent clinical trial of the Positive Parenting Program demonstrated a 28% reduction in substantiated child maltreatment, a 19% reduction in out of home placements and a 20% reduction in hospital and emergency room admissions for child maltreatment injuries.⁶¹ These large differences were observed at the county level for experimental versus control counties using countywide interventions rather than those targeted at high risk families.

Other primary prevention efforts have been shown to be effective in reducing exposure to a variety of toxic stressors. In a systematic review of prevention programs meeting rigorous methodological standards, WHO concluded that school-based programs to prevent child sexual abuse are effective in strengthening protective factors against this type of abuse, although the impact on rates of abuse was unclear.⁶² A systematic review and meta-analysis of 44 anti-bullying programs showed that overall, school-based anti-bullying programs are effective: on average, bullying decreased by 20-23% and victimization decreased by 17-20%.⁶³ Comprehensive smoking prevention programs have been widely successful in reducing exposure to tobacco.⁶⁴ These findings show that reducing the rate of exposure to chronic and toxic stressors is possible.

Increasing Community Resilience and Resistance to “Disease.” Public policies and programs that encourage connection to the community and that express norms that favor pro-social behavior help to provide the environments that promote health and wellbeing. Examples include⁶⁵

- Participation in church or other community group,
- Strong cultural identity and ethnic pride,
- Access to support services, and
- Community cultural norms against violence.

Community wide initiatives can help stimulate and strengthen communities, increasing their resilience to toxic influences. Tax policies⁶⁶, community coalitions⁶⁷, community university partnerships⁶⁸ and anti-violence initiatives⁶⁹ have all been shown to enhance community health and wellbeing. Grassroots efforts to develop resilient and sustainable approaches to the environment and the economy are emerging across the country and the globe,⁷⁰ and psychological and emotional resilience is an essential component.

Decreasing Individual Exposure to “Pathogens” (Toxic Stress). Once we understand the pathogenic effects of toxic stress, we have pragmatic as well as moral rationale to prevent exposure whenever possible. Programs that seek to remove or protect children or women from abuse or domestic violence, that provide community alternatives to jail or juvenile justice facilities, or that seek to minimize disruption in the lives of children in foster care are all designed to reduce individual exposure to trauma and toxic stress. Policies regarding the use of restraints in psychiatric treatment facilities seek to reduce the rates of re-traumatization experienced by persons in mental health crisis. Limiting the number of times a soldier can be deployed to a war zone or the total overall exposure of first responders to traumatic circumstances have similar goals. While the research on the impact of these programs is just beginning, it is reasonable to hypothesize that there will be a substantial public health benefit to reducing the overall exposure to toxic stress.

Increasing Individual Capacity to Resist “Infection.” Research shows convincingly that technologies exist that successfully increase resiliency – i.e., that strengthen individuals’ ability to cope with chronic and toxic stress in healthy ways. These techniques have been referred to as “behavioral vaccines” in recognition of the role they can play in preventing today’s epidemics.⁷¹ In 2009 the *Institute of Medicine* (IOM) released a synthesis of the research literature on the prevention of mental, emotional and behavioral disorders in young people. This report documents a formidable armamentarium of rigorously tested prevention interventions that have been shown to reduce the prevalence of socially maladaptive behaviors and promote the development of pro-social, adaptive behaviors. Importantly, many of these interventions target young children and their families and are therefore conceptually aligned with findings regarding the life-long impacts of early childhood experiences. The IOM conceptualizes preventive interventions in a life span developmental framework that is explicitly sensitive to developmental neuroscience. Stress results from unexpected and/or unmanageable experiences that are unpredictable and, from the individual’s perspective, uncontrollable. One method used to create greater control is the development of personal

competencies that help to reduce uncertainty and create environmental mastery. The sense of mastery that develops from specific behavioral success experiences, along with a sense of self efficacy and confidence that the stressful situation will be resolved, increases the individual's ability to modulate stressful reactions and reduces hormonal responses to stress.

Perhaps the best known of these interventions is the *Nurse Family Partnership*, in which nurses work with first-time pregnant women prenatally and for the first two years after birth. Nurses train and support these new mothers, increasing their competence to rear their infants effectively. The nurse family partnership and other similar interventions improve the mothers' caregiving competencies, promote mother-infant attachment and result in a broad range of beneficial effects on youth development and long-term health. Through these interventions, youth develop competencies that help them to navigate unpredictable environments and better manage their own emotional responses to stress. Participation in these programs improves social inclusion, improves bonding and cohesion in pro-social groups, facilitates healthful development, buffers stress, reduces the occurrence of maladaptive behaviors and ultimately prevents the emergence of behavioral disorders.

Long term follow-up data are also available for the *Seattle Social Development Project*.⁷² This intervention promotes opportunities for children's active participation in the classroom and family, and reinforces efforts and accomplishments. It involves teachers and adult caregivers in the intervention and was implemented in grades 1 through 6 with random assignment to classroom. Fifteen-year follow-up data are available for 27 year olds who have not received any systematic interventions since age 12. Data contrasting experimental and control classrooms show significant effects of the intervention on socioeconomic status, social engagement, completion of an associate's degree, rates of mental health symptoms, diagnosable mental illnesses and lifetime rates of sexually transmitted diseases.

The *Good Behavior Game* is another school-based classroom management technology used in elementary school. At ages 19 to 21, males who received the intervention in the first or second grade had significantly reduced rates of cigarette smoking, fewer alcohol or substance abuse/dependence disorders and significantly lower rates of antisocial personality disorder than students in the control classrooms.⁷³ These long-term outcomes underscore the value of skill-based interventions decades following their administration. These interventions improve resilience and adult achievement while helping to prevent the onset of mental and addictive disorders.

Resiliency training programs for adults have not been as well studied as those for children and youth. However, it is worth noting that the military has adopted a comprehensive program for building resilience in soldiers.^{74,75} The Army's "Comprehensive Soldier Fitness" (CSF) program was developed in part due to increasing rates of suicide and PTSD among soldiers returning from deployment. The program uses established principles of positive psychology to help prepare soldiers for sustained operations. The director of CSF has compared the program to marathon training, where the likelihood of injuries is reduced by preventative care and

training.⁷⁶ Contractors that work in areas of conflict or disaster are adopting similar resilience training programs.⁷⁷

Containing “Infection” with Effective Treatment. We also have considerable information about effective treatments for mental and addictive disorders. Effective treatment is critical not only because it benefits the individuals involved, but because it can help prevent the transmission of “infection” to others. Both mental illness and addiction in the family are considered adverse experiences in the ACE study. Children in households where these disorders are present are often exposed to unpredictable environments, and are at risk for multiple stressors. Effective treatment for family members can prevent or reduce negative impacts on the next generation.⁷⁸

Effective treatment programs exist for a wide variety of substance abuse and mental health conditions. A meta-analysis of 78 drug abuse treatment studies found a statistically significant and clinically meaningful impact of treatment in reducing drug use and crime.⁷⁹ Collaborative care approaches for treating depression in primary care show significant effects in improving depression 5 years following the intervention.⁸⁰ SAMHSA’s National Register of Evidence-Based Programs and Practices (NREPP), which lists prevention, promotion and treatment programs that are scientifically tested and readily disseminated (with at least one published comparative effectiveness study), includes 65 listings for substance abuse treatment and 51 listings for mental health treatment.⁸¹ There is also growing evidence that for individuals whose mental health and/or addiction problems are related to violence, addressing trauma directly, and in a way that fully integrates the trauma counseling with other treatments, is more effective than treatment without attention to trauma.⁸² Looking specifically at PTSD, a meta-analysis of psychotherapy found that the majority of patients treated in randomized trials recover or improve, making these approaches some of the most effective psychosocial treatments devised to date.⁸³ Although many patients continued to have residual symptoms, if we were to integrate the knowledge we now have about the neurological impact of chronic and toxic stress into our treatment interventions, it is likely that we could further improve outcomes.

Our understanding of the neurobiological underpinnings of stress-related conditions opens new possibilities for treatment.⁸⁴ We have long recognized that traumatized individuals respond to reminders of the past by automatically engaging in behaviors that were appropriate at the time of the trauma, but are no longer relevant, and that they have trouble with sustained attention and focused concentration. Many traumatized children and adults lose the ability to recognize their feelings, internal physical sensations and muscle activation – a phenomenon called “alexithymia.” The rational, executive verbal part of the brain – the part engaged by most verbal therapies - has limited ability to control emotional arousal or change fixed action patterns. Techniques that address awareness of internal sensations and physical action patterns – such as dialectical behavior therapy (DBT) – show great promise and deserve further study. Similarly, the lateral nucleus of the amygdala has been shown to be the critical structure in the brain in the formation of conditioned fear memories, which when coupled with a sense of helplessness, can result in chronic mechanistic compliance or resigned submission. Therapeutic approaches that move people into action – like improvisational theatre or self-

defense classes – can redirect the flow of information from the central to the basal nucleus of the amygdala and the motor circuits of the ventral striatum, and have the potential to help people overcome the habitual passivity that can be a hallmark of stress-related conditions.⁸⁵

In reality, the categories above are overlapping, and most interventions combine multiple elements. For example, the concept of “nurturing environments” has been proposed as a framework to integrate efforts to minimize toxic conditions; teach, promote, and reinforce pro-sociality; monitor and limit opportunities for problem behavior; and promote psychological flexibility.⁸⁶

SECTION VI. A PUBLIC HEALTH INFRASTRUCTURE FOR TREATMENT AND PREVENTION

Both the science and the practice of public health depend on an infrastructure for data collection and analysis, field research, local action (including program implementation), policy change, development and testing of new tools and public education.

Data and Surveillance. As early as the 17th century, the colonists recognized that they couldn’t protect people’s health unless they had hard facts about births, death and illnesses. Systems to gather vital statistics quickly became an essential part of public health.⁸⁷ Data were used to map of the outbreak of epidemics – for example, mapping cases of cholera helped John Snow identify the tainted pump. Likewise, surveillance systems were helpful in monitoring the spread of infectious diseases, which in turn allowed public health “detectives” to discern conditions in which a particular disease was likely to thrive.⁸⁸ If we are going to make progress with today’s epidemics, we will need an equal investment in data gathering and monitoring. For example, mapping outbreaks of bullying or street violence might help identify local circumstances that are causing the problem – or at the very least, would guide the need for intervention.

Unfortunately, much of the data and information that would be useful in addressing behavioral health epidemics are either not gathered or are not available for public health purposes. This is due, in part, to the lack of integration among various health and human services, and in part to the criminalization of many of the behaviors of concern. We know, for example, that children who witness a violent crime and women who are raped are both at elevated risk for future problems. However, since these events are tracked by the criminal justice system, data are not readily available for public health purposes. Similarly, we know that the impact of a traumatic event ripples through families and communities, but we have no way of systematically monitoring those impacts. We need surveillance of the factors that are known to underlie the development of behavioral health disorders and an integration of these data into a coherent public health strategy to ameliorate the effects of toxic stressors. As we do so, economies and individuals should become more resilient to stressful perturbations.

Field Research. Public health also depends on careful study of local environments. One of the hallmarks of the early public health movement was the deployment of teams of public health researchers to the site of new outbreaks, where the interaction of the disease with local geography, climate and culture could be closely observed. Their job involved administrative

duties (enforcing quarantines and other mandated procedures); detective work (looking for sources of contamination); and scientific observation (attempting to understand the spread of the disease and its potential containment). Often, local research led to solutions that could not have been developed from a distance. For example, understanding that yellow fever was spread by mosquitoes led to a national social policy of draining swamps. However, when there was an outbreak of yellow fever in an arid region of Mexico, it took careful field research to discover mosquitoes breeding in cast-off lye water containers. Likewise, it took years of painstaking local observation to identify the specific dietary deficiencies causing pellagra.⁸⁹ If we are going to develop an effective public health response to behavioral health epidemics, we will need to develop a similar capacity to conduct careful field observation.

Local Action To Build Healthy Communities. The physical infrastructure improvements that we associate with the germ theory – e.g., plumbing and sewers and waste treatment plants – are by definition local projects. In a modern parallel, “place-based initiatives” target policies, investment and the development of social programs to an identified community. These initiatives are locally-driven, based on the belief that local leaders are best positioned to identify local needs and effective strategies to build stronger, safer, healthier and more economically viable communities.⁹⁰ “Place-based” initiatives have been shown to be extremely effective. Examples include the *Harlem Children’s Zone*, an educational program for inner city youth,⁹¹ *Communities that Care*, a comprehensive youth development program in Washington state,⁹² and others that provide models for this community based approach and convincing data regarding their effectiveness. Most of the prevention programs described earlier also rest on the willingness and ability of local communities and/or local institutions for implementation. The Substance Abuse and Mental Health Services Administration (SAMHSA) has developed a five-step “Strategic Prevention Framework” designed to help states and local communities develop effective and sustainable prevention programs.⁹³

Policy Changes. By its very nature “public” health requires solutions that affect everyone – many of which require the development of regulations, standards and legislation. In the early days, public health was primarily a local concern, and no two cities or states had precisely the same policies. While the federal government periodically took action, particularly when an epidemic threatened large areas of the country, the U.S. Public Health Service wasn’t established until 1912, and wasn’t fully federalized until the end of the Roosevelt administration.⁹⁴

The public’s behavioral health today is significantly affected by federal, state and local policies. For example, the federal Violence Against Women Act, local and state statutes limiting smoking in public places, new federal-state disaster planning requirements, mandated child abuse reporting laws and the establishment of a refugee health and social service system - to name just a few – have had a profound impact on the public’s health. An effective response to the epidemics of today will require additional political action to stimulate the development of a policy framework that effectively represents our current knowledge.

Development and Testing of New Treatment and Prevention Techniques. Any public health problem seems daunting until the solution is identified and implemented. But the history of public health is replete with inspiring stories of scientists conquering seemingly insurmountable problems. Vaccines have been developed for dozens of diseases, from smallpox and diphtheria to polio, rubella and hepatitis B. Diseases caused by nutritional deficiencies have been virtually eliminated through dietary change or supplements. The development of antibiotics and new antiseptic procedures profoundly changed medicine. While the situation today may seem overwhelming, behavioral scientists display the same ingenuity shown by their predecessors. If we invest in research and development, the number of effective tools available for both prevention and treatment would grow accordingly.

Public Education. Education has always played a role in public health movements. Germ theory advocates quickly recognized that even aggressive short-term measures would ultimately be ineffective unless the public was educated about basic principles of hygiene. Courses were developed for primary and secondary schools⁹⁵ and public health reformers focused on educating the public about personal and family hygiene.⁹⁶ Contemporary public education efforts can help disseminate information regarding research based strategies for managing stress⁹⁷, early signs and symptoms of illness and information regarding how to seek and obtain help for these problems⁹⁸, workplace wellness and employee assistance programs that can better prepare employees to manage life changes⁹⁹. Public education efforts like these can both build individual resilience and develop a well-informed public that will support policies that promote overall health and wellbeing.

SECTION VII. A SYSTEMIC APPROACH TO POLITICAL ACTION

Many of the elements needed for a second public health revolution are in place. We have a theory, a causal model with substantial evidence, and proven methods for prevention and treatment. Further research and development efforts are clearly needed to devise, test and refine interventions to maximize effectiveness as well as to fully elaborate the genetic and environmental causal pathways and the neural mechanisms through which they work. However, important personal and social benefits are now potentially available. Failure to implement this knowledge is akin to ignoring problems with food safety or failing to vaccinate against polio or smallpox. What steps are now needed to create public momentum for a change of this magnitude? The history of the public hygiene movement is instructive.

Cholera and yellow fever, the diseases that provided the primary motivation for public health reform, were not the diseases with the highest mortality rates – tuberculosis and pneumonia caused more deaths. Nor were they the only epidemics spread by unsanitary conditions – diphtheria was a major epidemic disease throughout most of this period. However, diphtheria and other diseases like scarlet fever, typhoid, malaria and tuberculosis had become familiar disorders and the public had come to see them as inevitable. These endemic diseases lacked the drama of the “great pestilences” and the general population was resigned to their inevitability.¹⁰⁰

In contrast, an outbreak of cholera in any part of the world was enough to arouse newspapers, medical societies and civic authorities in every American port. Americans closely followed the course of cholera as it made its way through Russia and Eastern Europe to the Atlantic. The newspapers were filled with “cholera stories” and the New York Times editorialized on “cholera panics.” Other factors also heightened public concern about the problem, including the collection of vital statistics and evidence of the economic cost of sickness and death, illustrated vividly by epidemics of yellow fever which effectively closed down southern cities and brought economic activities to a halt.¹⁰¹

Virtually every sector of society mobilized in response to the perceived threat. State and municipal officials joined with medical societies to hold National Sanitary Conventions which met from 1856 to 1860. In 1884 President Chester Arthur issued a proclamation warning state officials of the danger. Businessmen in New York organized the “Sanitary Protection Society” to urge action. Others joined volunteer groups such as the “Howard Association” (originating in New Orleans and soon spreading to other southern towns and cities) to organize relief programs and provide medical care, housing and food for families of those stricken. Municipal authorities initiated massive sanitary campaigns and checked on food and water supplies. Voluntary sanitary associations sprang up across the country to improve water and sewage systems, clean streets, provide pure milk for infants and establish public health clinics. Congress passed the first national quarantine act and a measure creating the National Board of Health. Philanthropic organizations, which had grown with the accumulation of wealth by nineteenth century entrepreneurial capitalists, applied their funds to further the development of scientific models, and were a major force behind the mental hygiene movement. Change also occurred at the individual level. Daily bathing, taboos against spitting, new standards for personal and family hygiene and even a social demand for more “personal space” have all been attributed to changing social norms resulting from the public hygiene movement.¹⁰²

None of these changes came easily. Public health reformers in the late 19th and early 20th centuries were passionate advocates as well as scientists, and they fought for laws to support their plans. They believed that “the health of a community was the key measure of its success, and if pestilence and death stalked even one small segment of the population, it was a stark indication of the community’s political and social failure.”¹⁰³

The forces arrayed against public health reform must have at times seemed overwhelming. While some progressive businessmen recognized the long-term benefit of a healthy workforce, others were concerned that implementing public hygiene measures would interfere with business operations. Goldberger faced a particularly strong backlash from southern businessmen who feared that publicity about pellagra would drive investors and tourists away.¹⁰⁴ Opposition also came from people who were generally anti-government or who saw public health measures such as vaccination as a threat to individual rights. At times the issues were conflated with other political issues, such as anti-immigration sentiment or tensions between the north and the south. Surprisingly, one of the greatest sources of opposition came from the medical community. Some doctors had initially opposed the germ theory, feeling that it weakened their personal authority over patients, but physicians came to provide strong

leadership for the growing public health movement. Nearly all of the early presidents of the American Public Health Association were physicians.¹⁰⁵ Unfortunately, public health and medical care systems eventually developed separate – and often oppositional – courses.¹⁰⁶

The sheer magnitude of the changes required was daunting to many. For example, when Goldberger began his crusade to eliminate pellagra, public health authorities could not imagine being able to change the eating habits of an entire population. For others, the theory of dietary causation was simply too far removed from what they had been taught: “Having worshipped at the shrine of bacteriology, they were unwilling to reconsider their basic assumption of disease causation.”¹⁰⁷ Over time opposition of this nature faded, as new intervention strategies emerged and social conditions changed. Pellagra was ultimately conquered when the FDA established nutritional standards for white flour, including niacin, and states began mandating enrichment. The poverty and specific diet that had caused pellagra changed more gradually, but were eventually eliminated by post-war economic growth.¹⁰⁸

Over the long term, public health measures waxed and waned with changing sociopolitical circumstances. A strong middle class was essential in support for public health, since without a middle class, the rich simply lived “separate and unequal lives, maintaining clean and spacious homes and using private systems of care.” In fact, the public’s health usually worsens when the gap between rich and poor widens,¹⁰⁹ and some argue that inequality itself is the primary public health condition to be addressed.¹¹⁰

Theory as a Tool for Generating Momentum. The sanitarians that drained swamps and built sewage systems were somewhat effective in preventing contagious diseases, but without a clear rationale for why their measures worked, it was hard to generate public support. Politicians developed a pattern of investing money during an epidemic or crisis and cutting funds when it died down, and advocates had “little choice but to await an epidemic and, capitalizing on the public’s hysteria, twist the arms of politicians and men of commerce in order to obtain the desired laws and funds.”¹¹¹ The germ theory made support for prevention efforts more sustainable. Today, science has established a causal mechanism linking environmental conditions to adverse outcomes. Like the germ theory, this provides a basis for advocates to demand the development and implementation of effective intervention technologies – especially when coupled with evidence that our social order or national well being is threatened.¹¹²

Building Coalitions. The theory described in this paper illustrates how individual vulnerability when combined with chronic and toxic stress contribute not just to one or two illnesses, but to a variety of interrelated conditions that are seriously affecting our mental, general and economic health. It is clear that trying to eradicate one risk factor to exclusion of others will ultimately be less productive than more systemic approaches. Advocates may focus on violence against women, substance abuse, violent crime or bullying, but all of these “toxic stressors” contribute to the underlying problem. In the public hygiene movement, public health measures were driven largely by a fear of cholera and yellow fever, but most interventions – like clean water, safe food and effective sewage systems – prevented dozens of different

diseases. Similarly, efforts to make our communities safer, more inclusive, less toxic and less violent will help us to reduce a number of problems that may appear to be distinct but aren't.

It is also essential that we address "treatment" and "prevention" as two necessary and interrelated efforts. From a scientific perspective, understanding the mediating role of toxic stress reminds us that effective treatment for one individual often serves as prevention for others. From a political perspective, the alliance is critical. Tension between public health and health care ultimately resulted in the elevation of hospitals and technology and the diminishment of public health and those specialties associated with it.¹¹³ Serious efforts need to be undertaken to bring behavioral health treatment and prevention strategies and practitioners into closer alignment.

Understanding the common etiology of behavioral health and social epidemics makes it easier for apparently disparate service systems to work together. Health and human service systems generally work in isolation, each responding to one or more social or health problem without recognition of their common antecedents. As long as the mental health system sees its mission as treating "mental illnesses," the substance abuse system focuses only on "addiction," and the justice system defines their role as controlling "criminal behavior," forging effective, unified strategies is difficult, at best. Similarly, health care systems attempting to reduce the burden of chronic illness, schools trying to improve academic achievement and businesses focusing on increased productivity are unlikely to see themselves as natural partners. But when the underlying role of common risk and preventive factors is recognized, potential linkages appear and natural partnerships emerge. For example, a working group on women, violence and trauma - involving seven federal agencies and dozens of departments and divisions - has found that the concept of "trauma-informed care" provides a framework for effective collaboration focused on creating healthier environments and more effective services.¹¹⁴

Creating Public Awareness and Support. It has been argued that the most important factor in the public hygiene revolution was the "sanitary-bacteriological synthesis" that occurred in public consciousness. Average citizens may not have understood the importance of the distinction between "miasmas" and "germs," but they came to understand that diseases were associated with conditions of dirt and filth, and over time, the norms for community sanitation shifted.¹¹⁵

Currently, social determinants are not widely understood, and behavioral health problems are often seen as irrational, self-destructive behaviors rather than coping responses to toxic stress. Social policy and practice will shift when the public comes to understand the relationship between toxic stress and the social ills that plague our society today. As a first step in developing public support a social marketing campaign should be developed that identifies key audiences and develops and tests messages that effectively communicate the urgency and opportunity provided by our current knowledge. Use of sophisticated behavior change strategies should be employed that are informed by theories of change such as the transtheoretical model.¹¹⁶ In this model, stages of change are identified and

messages/technologies are designed and implemented to stimulate and support each stage of a change process.

It will also be critical to dramatically detail the effects of our contemporary epidemics on the health and productivity of our communities and nation. Providing local as well as national estimates of wellbeing may be critical, and variations within local areas (states or communities) may be particularly enlightening. Beginning in 2009, the Centers for Disease Control (CDC) included an optional module on adverse childhood experiences in their Behavioral Risk Factor Surveillance Survey (BRFSS), an extensive telephone survey conducted through state health departments. The first report was released in December, 2010.¹¹⁷ Demonstrating the linkages between causal factors and health/social indicators builds a platform for local action. At least one state, Washington, has used state level ACE data to inform new policies and program development across juvenile justice, education, child protective services and rehabilitation services.¹¹⁸

Mobilizing All Sectors for Local Action. Federal, state and local governments; community and volunteer groups; providers and professional associations; the business community; and private philanthropy all have roles to play. New platforms need to be considered that strengthen the community's capacity to reduce and contain the multiple "pathogens" underlying today's epidemics as well as strengthening the population's resilience to these "infectious" agents. This can best be done by involving local community leaders in identifying their own priorities for action, developing their own intervention strategies and individualizing measures of progress. Support for the development of local coalitions to address local problems will be essential; for example, supplying simple, usable technologies for needs assessment and the selection of community targets. The use of tested technologies will assist implementation at the community level.

State health departments working with juvenile justice, corrections, education, labor and community and economic development must also examine their policies and incentives to help assure that they are in harmony and support the development of overall community well being. Substantial infrastructure exists to pursue the sector-specific aims of these agencies. This infrastructure must be adjusted to support these broader goals and technologies. Use of costing models that better represent the full governmental costs and benefits of programs rather than those that accrue to a particular sector (see for example the Washington State example)¹¹⁹ might help to develop the empirical platform that can be used at a state level to motivate action and evaluate results.

The call for a public health approach to behavioral health is not new. In 1979 and 1980, in a two-volume report titled *Healthy People*, Surgeon General Julius Richmond called for "a second public health revolution" focused on diet, smoking, drug abuse, exercise, accidents and safety, and setting public health goals including reducing infant mortality, etc. Thirty subsequent years of research has now given us the scientific basis to realize this vision.

Ultimately, an effective public behavioral health response will depend on a strong overall public health system. Unfortunately, we have allowed our public health system to fray over the past decades. As one author put it: “These (public health) crusaders would find it amazing to witness the erosion of America’s public health infrastructure during the later 20th century, the low status ascribed to public health physicians and scientists, the legal limitations placed on their authority, and the disdain with which American’s viewed their civil servants.”¹²⁰ Our best hope for addressing the epidemics of today rests on the re-establishment of a strong public health system – and one with a strong behavioral health component.

Conclusion. The United States is facing a series of challenges that are undermining the health of our citizens and our leadership in the world. Like the people of the mid-19th century, we’ve become accustomed to these endemic, pervasive personal and social ills. We are suffering the consequences of problems that are, in fact, preventable. Just as a wide variety of stakeholders in the mid-19th century rallied behind the “germ theory” to initiate a broad social reform effort, we must now begin to educate community, state and national leaders to the situation facing us. Our national and local leaders need to understand the insidious effects of our contemporary social epidemics and the theory that underlies their development. Perhaps most importantly, they need to become informed about the effective, validated technologies that are already available – technologies that can reduce the prevalence of health, behavioral health, and social problems, strengthen pro-social behaviors and create the community cohesion needed to buffer the effects of toxic stress and trauma. Making the practical changes necessary to improve our health and preserve our world leadership is well within the American spirit of ingenuity and accomplishment. We need to call upon the spirit and determination that built America to rally behind a new public health agenda and to address our current personal and social challenges. We clearly can and must do it now.

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