

Impact of Toxic Stress on Individuals and Communities: A Review of the Literature

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Introduction

In this review we summarize existing literature on the overall health and wellbeing of the U.S. population. We review data indicating that exposure to trauma, especially early in life, is an important determinant of health status. Throughout the review, we refer to a condition called toxic stress. Researchers at Harvard's Center for the Developing Child distinguish toxic stress from positive and tolerable stress.^{1 2} They define toxic stress as involving:

“...strong, frequent, and/or prolonged adversity—such as physical or emotional abuse, chronic neglect, caregiver substance abuse or mental illness, exposure to violence, and/or the accumulated burdens of family economic hardship—without adequate adult support. This kind of prolonged activation of the stress response systems can disrupt the development of brain architecture and other organ systems, and increase the risk for stress-related disease and cognitive impairment, well into the adult.”³

We first summarize measures of our health status in contrast to other areas of the world. We conclude that there are fundamental concerns with our overall health that should prompt a focused public health response. Throughout the document we use the World Health Organization's definition of health. In this definition, health involves more than the absence of disease. It also includes an individual's ability to realize his/her full potential through active participation in meaningful social roles.

We also use the concept of 'human capital' to discuss the consequences of toxic stress. Human capital is the overall ability of a population to be economically productive. It is like financial capital in that it represents the human resources necessary for economic activity. When our human capital is weakened, it decreases our ability to have productive communities and a successful nation.

Exposure to toxic stress is an important cause of the decline in our overall wellbeing and human capital. We review the emerging science about the ways in which stress interacts with inborn strengths and vulnerabilities to produce changes in our brain, hormonal and immune systems. These changes, in turn, are associated with behavioral and general health.

In the third section, we summarize the rapidly growing literature on the effects of toxic stress on health and behavior. We have long known that social factors (e.g. poverty, racism, inequality, violence) are important determinants of health and mental health. We review the consequences of

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these social determinants by highlighting the well-established relationship between adversity, particularly in childhood, and later behavioral health and health problems.

Not everyone exposed to adversity develops health problems. Resilience is an important concept in understanding why some people are affected and others are not. By better understanding resilience we can design interventions that help buffer the impacts of toxic stress. The final two parts of the review focus on interventions – both prevention and treatment. Here we use a risk and protective factors approach. Strategies that reduce the level of exposure to stress reduce external risks, while strategies that strengthen protective factors – either in the individual or in the social environment – help buffer the impacts of stressful exposure. Finally, for persons who have developed problems related to trauma, treatment approaches are discussed. Fortunately, we have a strong science base for addressing these problems through prevention and treatment. Our challenge is to implement what we know can make a difference for our communities and our nation.

Indicators of Health and Wellbeing

Despite the common belief that U.S. citizens enjoy the best health and living conditions in the world, we lag behind in many areas of health and wellbeing. In this section we document general and behavioral health, economic and social indicators that should cause us great concern. Like the infectious epidemics of the 19th century, these conditions comprise the public health crises of our generation. They clearly call for a focused public health response. We also feature areas in which we are improving that may help map a public health response.

Today's epidemics

General health problems. According to the World Health Organization, in 2012 the U.S. ranked 36th out of 194 countries in life expectancy, dropping from 28th in 1990.⁴ The U.S. ranks 38th in disability adjusted life years, reflecting substantial impairment resulting from illness and injury. Recent research completed by the Institute of Medicine (IOM) compared the U.S. to 16 similar high income countries. The U.S. consistently has the worst health outcomes, with the highest 0-5 child mortality rate, maternal mortality rate, and rate of obesity across all age groups. The U.S. has the second highest rates of death due to coronary heart disease, lung disease, and non-communicable diseases.⁵ Moreover, U.S. health is deteriorating. Between 2002 and 2012 the rates of adults with 2-3 chronic conditions rose from 17.9% to 19.1% and the percentage of adults with four or more chronic conditions rose from 3.6% to 4.3%.⁶ In 2013, 28.9% of adults over age 20 were obese, compared with 19.4% in 1997.⁷ Diabetes rates nearly doubled from 5.1% of the adult population in 1997 to 9.3% in 2013.⁸ These deteriorating health indicators stand in vivid contrast to per-capita expenditures on health, which is more than double that of the other Organization for Economic Cooperation and Development (OECD) nations. We currently spend about 17% of GDP on health care.⁹ The Commonwealth Fund reports that among 11 similar countries, the U.S. consistently has the most expensive and poorest performing health care system. The U.S. ranked last each year since 2004, and is 11th on measures of efficiency and equity and 9th on measures of access.¹⁰

Behavioral health problems. Like general health conditions, the U.S. has staggering rates of mental health and substance abuse conditions. In fact, the most recent rankings suggest that the U.S. has the highest rates of mental health conditions and the second highest rate of substance abuse problems in the world.¹¹ Almost half of Americans, 47.4%, will develop a mental health or addiction condition in their lifetime.¹² Among adolescents, 40.3% meet criteria for a DSM-IV disorder, including both mental health and substance use conditions, in any given year.¹³ Additionally, alcohol consumption is

increasing. In 1997, 21.1% of adults had five or more drinks on at least one occasion in the past year. In 2013, that percentage had risen to 23.3.¹⁴

Injury, homicide and suicide. Compared to the 16 similar countries included in the IOM report, the U.S. has the highest rate of death by violence, almost three times higher than the next country.¹⁵ The U.S. accounts for 80% of all firearm deaths among the OECD nations – far exceeding its proportion of population.¹⁶ According to the Centers for Disease Control (CDC), 11,522 people were murdered with firearms in 2011, a rate of 3.7/100,000. For males ages 15-24, the rate was 15.6/100,000. Even more Americans died by suicide using a firearm in 2011 - 19,990 (rate of 6.4/100,000) - and a staggering 39,518 individuals died by suicide using any method in 2011 (rate of 12.7/100,000).¹⁷ Suicide rates for individuals between 35 and 64 increased 28% from 1999 to 2010.¹⁸

Economic indicators. The U.S. also lags other countries in the economic health of the population. Of the 34 OECD countries, the U.S. had the sixth highest child poverty rate (21.8%).¹⁹ ²⁰ In 2012, 46.5 million people lived in poverty. This is 15.0% of the population,²¹ significantly higher than 12.2% in 2000.²² The U.S. has the highest rates of income inequality of comparable OECD countries. U.S. earners in the bottom 10th income percentile earn 47.7% of the country's median income, compared with the average of all OECD nations of 62.0%.²³

Social indicators. The U.S. has continued to lag behind comparable countries on many important social indicators. The U.S. incarcerates far more individuals than any other country, with a total jail and prison population of 2.2 million. This is a rate of 707/100,000 population, and dramatically exceeds that of all other nations.²⁴ Of 34 OECD countries and 31 partner countries, the U.S. ranked 20th in reading in 2012, down from 10th in 2009; 30th in math, compared with 24th in 2009; and 23rd in science, slipping from 19th in 2009.²⁵ In 2011, the World Economic Forum ranked the U.S.'s education system 26th in its ability to prepare students for a competitive economy.²⁶

Many American children end up in the child welfare system, victims of child abuse and neglect. In 2012, 678,810 children were abused or neglected, a rate of 9.2/1,000. Children under 1 year of age had the highest rate of abuse, at 21.9/1,000. Child abuse impacts healthy development, and also resulted in 1,640 deaths in 2012. Over 70% of these were of children under the age of 3. Eighty percent of the fatalities were caused by one or both parents.²⁷ Lastly, according to the IOM, more U.S. teenage girls become pregnant than those in the 16 comparable countries. This is a rate of 41.2/1,000 girls aged 15-19, far higher than the next highest country, the U.K. at 29.6/1,000. Our teen pregnancy rate is almost 10 times higher than that of Switzerland, the country with the lowest rate.

Overall measures of wellbeing. Several measures have been developed to measure overall performance in health, opportunity, and sustainability. Each measure indicates that the U.S. lags behind similar countries. The Social Progress Index utilizes 54 social and environmental outcomes across three dimensions - basic human needs, foundations of wellbeing, and opportunity. Of 132 countries, the U.S. ranks 16th overall. We rank higher than similar countries on just four indicators (freedom of speech, affordable housing, tertiary schooling, and number of ranked universities). Compared with similar countries, the U.S. performs worse on 25 indicators, including several of the health and injury measures cited above (e.g., life expectancy), primary and secondary school enrollment, freedom over life choices, and inequality in educational attainment.²⁸ The Social Sustainability Index measures the sustainability of each country on three dimensions - human wellbeing, environmental wellbeing, and economic wellbeing. In 2012, the U.S. ranked 116 out of 151 countries for overall sustainability, a drop from 93rd in 2006. In the human wellbeing dimension, the U.S. ranks 32nd, about on par with its ranking in 2006. The U.S. ranks 125th in environmental wellbeing, demonstrating poor performance in our

ability to take care of the environment. The U.S. also scores low on economic wellbeing at 102nd, down significantly from 45th in 2006.²⁹ The environment is an often overlooked contributor to population health. The Happy Planet Index uses environmental measures to determine how many long and happy lives countries produce per unit of environmental input. The U.S. ranks 105th out of 151 countries with a ranking of 33rd in life expectancy, 17th in experienced wellbeing, and the 6th highest ecological footprint at 145th.³⁰

Progress to date

Many of the indicators used to assess the health and wellbeing of the nation are quite concerning. However, some outcomes have improved, through directed efforts by federal, state, and community leaders. This section will review where improvements have been made to population level health and wellbeing.

Crime and violence. Despite incarcerating the most individuals in the world, our adult and juvenile correctional populations have declined in recent years. The highest rate of jail incarceration occurred in 2007. This rate dropped considerably by 2013 (259 to 231/100,000). The number of incarcerated juveniles is down from 5,400 in 2012 to 4,600 in 2013.³¹ Crime rates are also on the decline. In 2011, the U.S. had 31% fewer juvenile arrests than in 2002, with declines in violent crime, property crime, forcible rape, and murder. Violent crime among adults declined 12% from 2002 to 2011, with declines in murder and forcible rape.³² The total rate of sexual violence for females aged 12 and older dropped 58% between 1995 and 2010. Rates of completed rape declined from 3.6/1,000 females over the age of 12 in 1995 to 1.1/1,000 females in 2010.³³ Intimate partner violence has also seen a significant decline in recent years. The rate of serious intimate partner violence (i.e., rape or sexual assault, robbery, and aggravated assault) declined by 72% for females and 64% for males from 1994 to 2011. The rate of simple assault by an intimate partner declined by 70% for females over the same period.³⁴

School environment. Crime at school is also on the decline. Between 1992 and 2012, the rate of victimization of students ages 12-18 at school was reduced from 181/1,000 to 52/1,000. Victimization away from school also declined significantly, from 173/1,000 to 38/1,000. Gang involvement dropped from 20% in 2009 to 18% in 2011. Among students in urban areas, the rate dropped from 31% to 23%. Other problems contributing to unhealthy school environments also declined. Measures included acts of disrespect (9% in 2009-2010 from 11% in 2009-2010), use of hate-related words (12% in 2001 to 9% in 2011), hate-related graffiti (36% in 1999 to 28% in 2011), and illegal drugs being offered or sold (32% in 1995 to 26% in 2011).³⁵

Other economic and social indicators. The U.S. has also seen a decline in several economic and social indicators. Compared with similar nations, our absolute poverty rate is lower, indicating a higher overall standard of living for Americans than for individuals living in other high income countries.³⁶ The U.S. has also seen a decline in victims of child abuse. In 2012, 678,810 children (9.2/1,000) were abused or neglected compared with 704,714 (9.5/1,000) in 2008.³⁷ And although the U.S. education system has been found to lag behind comparable countries, since the 1970s the high school dropout rate has been on the decline. About 88% of Americans complete high school, the highest completion rate of the 17 countries studied by the IOM. The U.S. also has the second highest college completion rate, after Canada.³⁸

Summary

U.S. health and well being lags behind much of the world. Our international competitiveness is being undermined by these problems in human capital. We argue that these indicators reflect

contemporary public health crises, comparable to infectious epidemics during the 1800s. However, these problems are not intractable or inevitable. In areas where we have developed and implemented social policies – such as reduction in child abuse – we’ve seen improvements. These improvements demonstrate that we can successfully address these problems if we understand their etiological roots.

The Developmental Roots of Human Health and Wellbeing

Several areas of health and human capital should be of great concern to us. Deficits in these areas are among the most significant public health challenges of the 21st century – as profound a concern as the infectious epidemics of the 1800s. An understanding of infectious disease helped to shape an organized public health response in the 19th century. In the same way, emerging science about the underpinnings of our current public health crises suggests strategies for a public health response. Here, we review the evolving science concerning the interaction of biology and environment in the production of health.

Toxic Stress

Stress Response System. Individuals’ response to stress and its long term impact on their wellbeing involves both their personal biological vulnerability (genetics) and the environments in which they live and grow. The stress response system has developed through the evolution of our species to respond to danger. It involves physical responses such as increased heart rate and increased release of energy to enable the ‘fight or flight’ response. These responses involve different parts of the nervous and endocrine systems. They are effective in keeping us safe when we respond to an acute danger. However, when exposed to prolonged stress and/or severe adversity (toxic stress) the persistent activation of the stress response and subsequent exposure to stress hormones damages brain structures and affects energy metabolism, causing a ‘dysregulation’ of the stress response system.³⁹ Changes in these biological systems underlie long term problems in health and human functioning.

Damaging Effects of Stress. Exposure to toxic stress early in development, when the brain is most vulnerable, can leave a long term imprint. Much of the cognitive and emotional preparation for a successful life is determined during early stages of development. During this time, the nervous system is growing and the structure of the brain is being constructed. Prolonged activation of the stress response in the absence of protective buffering causes long term changes in the brain’s structure. This process is referred to as the ‘biological embedding’ of experience.^{40 41} These neural changes disrupt development of the prefrontal cortex. They also lead to emotional problems and negatively affect working memory, attention and inhibitory control.⁴² Prolonged exposure to toxic stress throughout life can also damage the organism⁴³ and may result in damage to cells and chromosomes, causing a shorter lifespan as well as the development of chronic illnesses and disability.⁴⁴

The long term effects of toxic stress (either persistent or severe) depend on the stage of brain development when the stress occurs. Prenatal and early life stress has the broadest impact, since all aspects of the brain are undergoing rapid development. Stress early in life is associated with memory problems and can negatively impact an individual’s ability to learn. Stress later in childhood and adolescence has more specific effects, since several areas of the brain have developed at this point and are less vulnerable to the harmful effects of stress. Exposure to toxic stress during this period can result in difficulty in attention and impulse as well as emotional control. Exposure in late adolescence or early adulthood results in heightened fear response and hyper-reactivity to stressful stimuli.⁴⁵

Toxic Stress

During the older adult years, the effects of stress amplify the aging process, affecting memory, cognition and emotion in an age-related way.⁴⁶

The endocrine and immune systems are also affected. People exposed to chronic stress show increased levels of stress hormones (glucocorticoids). The overexposure of these hormones in the body can interfere with their effects. These hormones are involved in nearly every important physiological process and complete resistance to them would result in death. Partial resistance decreases the efficiency of important biological processes, and can cause problems with inflammation as well as other central nervous system functions. Toxic stress, therefore, can be associated with elevated inflammatory responses that can cause serious health conditions like autoimmune illnesses (arthritis, allergies, asthma, etc.). It is clear that toxic stress poses a general threat to health and wellbeing. It is also important to note that biology is not destiny. Although exposure to toxic stress can result in damage to the brain and other parts of the body, many of these effects can be reversed – particularly behavioral health problems. As will be discussed below, trauma informed treatment strategies have been shown to ameliorate the behavioral health effects of early life adverse exposure in both children and adults. There is growing evidence that recovery from trauma is a natural biological process that can be encouraged with appropriate treatment and supports.⁴⁷ Similarly, effective environmental strategies can reduce exposure to risk factors, such as the availability of alcohol and tobacco, reducing their use and long term health effects. The earlier the effects of toxic exposure are addressed, the more effectively they can be reversed.⁴⁸ This underscores the importance of prevention and early intervention for overall health.

Genetic Influences

Epigenetics. Epigenetics is the study of the effects that the environment exerts on the expression of an individual's genes. Since genes contain the codes for all aspects of human anatomy, changes in how they are expressed can have dramatic and long term effects on the body and behavior. These effects seem to be important in the biological embedding process.⁴⁹ Early life exposure to toxic stress may impact the DNA that codes for structures involved in the regulation of stress hormones.⁵⁰ Labonte and colleagues,⁵¹ for example, reported damage to structures in the brains of individuals with abuse histories who completed suicide relative to other, non-abused suicide victims and matched controls. Much work has also been done on animal models. Roth et al. found that exposure to early life abuse in rats showed effects on a brain growth factor that was associated with underdeveloped brain tissue.⁵² Importantly, the changes in DNA expression found in these rats were also found in their offspring that had not been abused. This suggests that some adverse experiences can have multi-generational impacts - literally being inherited. These "epigenetic regulator mechanisms" essentially act as switches for neural development, plasticity and the development of disorders.⁵³

Picard and colleagues suggest that poor regulation of stress hormones can impact the functioning of cell energy metabolism throughout the body. The cellular byproducts of these problems promote cell aging and inflammation.⁵⁴ These mechanisms of energy metabolism can also increase the likelihood of obesity and diabetes. By operating on such an essential part of every cell in the body, the effects of toxic stress can have dramatic, organism-wide effects on health and longevity.

Genotype Environment Interactions. Another promising area of investigation involves the interaction of a person's genes and the environments in which he/she lives and grows. While the findings in this area remain somewhat controversial,⁵⁵ much research is ongoing. Findings indicate that persons with specific genes related to the neurotransmitter serotonin who are exposed to stress are more likely to have antisocial behavior, anxiety disorders and depression. Additionally, Brody and

colleagues demonstrated that youth with a specific array of two genes who experienced less supportive family environments had significantly higher stress response than individuals with greater family support.⁵⁶ This work suggests specific ways in which a person's genes impact their vulnerability to toxic stress, conferring resilience to some individuals and increased risk to others.

Summary

Research on the effects of early childhood adversity and exposure to toxic stress over the life span are associated with important changes in the structure of neural, endocrine and immune systems. These changes are, in turn, related to functional changes in behavior and metabolism. Effects on brain structures have been demonstrated to be associated with poor stress regulation as well as to deficits in memory, emotion and executive control. These disruptions in development, as we will discuss below, provide the foundation for the behavioral health problems that underlie our current public health crises.

The science exploring how adversity interacts with genetic vulnerability is progressing rapidly, but is still at a relatively early state. Stress hormone regulation may be central to the molecular mechanisms through which adversity impacts development and behavior. Given what we know about the multiple effects of adversity and associated risk and protective factors, we can begin to outline a public health response.

Impact of Toxic Stress across the Lifespan

Traumatic events are common across the lifespan. The 1995 National Co-morbidity Survey found lifetime prevalence of trauma to be 60.7% for men and 51.2% for women.⁵⁷ More recently, almost 90% of respondents to the National Stressful Events Survey reported exposure to at least one traumatic event; 30% reported six event types.⁵⁸ When other sources of toxic stress are considered, it seems clear that these experiences are near-universal. Given what we know about the biological embedding of early experience, it is not surprising to find that exposure to toxic stress has profound and wide-ranging impacts on all important aspects of life.

It has long been accepted that social factors affect health and productivity.⁵⁹ Research strongly suggests that toxic stress in childhood mediates this relationship through a developmental cascade effect described below. Traumatic experiences in adulthood also increase risk, although the biological mechanisms are not as well established. In this section, we review research on the relationship between toxic stress and poor outcomes across the lifespan. This research shows that environmental factors play a key role in the development of a variety of conditions. In some cases, genetic factors are also involved, reflecting the complex gene-environment interactions described earlier. These findings have significant implications for both prevention and intervention.

Adverse Childhood Experiences and Life Course Epidemiology

The Adverse Childhood Experiences (ACE) Study⁶⁰ demonstrates a strong relationship between ten categories of childhood adversity and poor health and social outcomes in a group of 17,000 middle class adults. The relationships are statistically powerful and "graded" – the more adverse events, the worse the outcome. This shows that risk accumulates across multiple adverse events, and raises the possibility of a causal relationship. All categories of ACEs have similar impact, and the occurrence of one adverse event increases the likelihood of another. These "chains of risk" increase the importance of prevention, since each adverse event prevented reduces the risk of subsequent adverse events.

The ACE study is an example of “life course epidemiology.” This approach examines the impact of early life events on later development of disease, integrating biological and social risk processes.⁶¹ To date, the ACE study has resulted in over 80 scientific articles and has generated substantial interest among policymakers, researchers and the general public. An international version of the ACE questionnaire has been developed⁶² and ACE categories are being refined to improve predictive ability.⁶³ The ACE questionnaire has been added to the annual Behavioral Risk Factor Surveillance System (BRFSS); data from 20 states show that the basic findings hold.⁶⁴ A growing number of studies show similar relationships using different methodologies, populations, sources of toxic stress, and outcome measures. The body of research continues to expand, leaving little doubt about the basic impact of toxic stress and trauma on a wide variety of health and social outcomes.

Health, Behavioral Health and Social Effects in Childhood

Early exposure to toxic stress is associated with multiple health and social problems in children and adolescents. The consistency of these effects suggests that reducing exposure to toxic stress could greatly improve overall health and wellbeing.

Sources of toxic stress. Research has documented the negative impact of a wide variety of stressors, including child maltreatment, bullying, interpersonal and community violence, disasters, accidents, life-threatening illnesses, socioeconomic status (SES) and racism. The relationship between SES and negative outcomes has been especially well-replicated,⁶⁵ possibly because living in poverty exposes people to unpredictable environments, lack of resource buffers, and social stigma.^{66 67 68} As in the ACE study, the impact of different stressors appears to be cumulative; children exposed to multiple traumatic events show significantly more symptoms and problems than those without multiple traumas.⁶⁹ However, there is emerging evidence that different types of traumatic exposure may have specific effects. In one study, for example, exposure to community violence was particularly associated with anger and externalizing behaviors.⁷⁰ In another study, neglect had a stronger impact on school performance than abuse.⁷¹ Better understanding both the additive and the unique effects of different sources of traumatic stress may have important implications for intervention.

Impact of toxic stress across domains. There is a very strong relationship between childhood adversity and the development of emotional and behavioral problems in children. One literature review found “overwhelming” evidence that maltreatment affects the development of mood and anxiety disorders, aggression, social skills deficits, peer relations and substance abuse in children and youth.⁷² Children exposed to adverse events start using substances earlier and have higher lifetime rates of substance use.^{73 74} The relationship also holds for the most serious mental illnesses. Children who are bullied or abused are three times more likely to have psychotic symptoms than those who are not. Children who experience both forms of childhood violence are nearly six times more likely to have psychotic symptoms.⁷⁵ These results are consistent across studies. A meta-analysis found that exposure to childhood adversities nearly doubles the risk of developing psychosis.⁷⁶

Childhood adversity also affects educational achievement, including special education placements, grade retention, achievement test scores and attendance. Parental neglect⁷⁷ and bullying have both been linked to academic problems. Longitudinal data suggest a developmental cascade model, with toxic stressors leading to developmental and psychological problems which in turn affect academic performance and lead to additional problems over the lifespan.^{78 79 80} This developmental cascade model is supported by research on brain development. One study demonstrated that functions controlled by specific areas of the brain known to be sensitive to early toxic stress were affected by socioeconomic status.⁸¹ As predicted, children with lower SES performed more poorly on measures of

language, long term memory, working memory and executive control, confirming the impact of stressors associated with poverty and their effects on specific areas of brain development.

Finally, exposure to toxic stress has been shown to impact measures of general health in children, including asthma, obesity and less conclusively, cardiovascular disease.^{82 83 84} Risk factors for obesity include adverse childhood experiences, mothers who experience repeated interpersonal violence, and living in unsafe neighborhoods. The relationship is mediated by gender; girls' weight appears to be more affected than boys'.⁸⁵ Childhood asthma appears to be related to a number of environmental conditions, including parent tobacco use and pollution as well as toxic stress.⁸⁶

These effects are highly interrelated. The structural remodeling of the brain caused by stress affects learning, memory and control systems, which leads to educational problems. Poor educational achievement may, in turn, increase environmental stress and maladaptive coping strategies (e.g., dropping out, substance use) that further impair educational achievement, establishing a 'vicious circle'. Endocrine and immune system changes likely underwrite later health conditions, which may also be affected by the use of substances. Without effective intervention, this developmental cascade continues into adulthood.

Health, Behavioral Health and Social Effects in Adulthood

Sources of toxic stress. The ACE study found significant relationships between 10 types of childhood adversity and a wide variety of adult outcomes. The ACE categories are: emotional, physical and sexual abuse; household domestic violence; substance abuse, incarceration or mental illness of a household member; parental separation; and emotional and physical neglect. Subsequent research has found similar relationships between adult outcomes and additional childhood stressors, including harsh physical punishment,⁸⁷ premature birth,⁸⁸ and family history of suicide.^{89 90} Research has also documented the impact of traumatic events occurring in adulthood, including rape and sexual assault,⁹¹ physical assault and domestic violence,⁹² wartime trauma,^{93 94} and stressful life events.⁹⁵ As in children, the impact of toxic stress in adults appears to be additive, with strong graded relationships between adverse events and negative outcomes. While the research is still evolving, it appears that toxic stress and trauma in childhood interacts with traumatic experiences in adulthood to further increase risk.

Impact of toxic stress across domains. A link between childhood adversity and adult general health was established by the ACE study.⁹⁶ This finding has now been replicated numerous times using a variety of study populations and methodologies. A recent meta-analysis of 24 studies found that child abuse was most closely associated with adult neurological and musculoskeletal problems, followed by respiratory problems, cardiovascular disease, gastrointestinal and metabolic disorders.⁹⁷ A "partial list" of diseases suspected by researchers to be affected by stress or trauma includes Type 2 diabetes, Crohn's disease, Alzheimer's disease, hypertension, irritable bowel syndrome, obesity, arthritis, fibromyalgia, chronic fatigue syndrome, chronic pain syndrome, osteoporosis, colitis, and some forms of cancer.⁹⁸ Clearly, toxic stress and trauma are having a profound negative impact on the public's health. Even a small reduction in childhood trauma would likely result in significant improvements in overall public health, as well as substantial healthcare savings.

There is also a very strong relationship between childhood adversity and adult mental health disorders. In the ACE study, 54% of depression in women could be attributed to adverse childhood experiences,⁹⁹ and people with 7 or more ACEs were five times more likely to experience hallucinations.¹⁰⁰ A significant body of subsequent research links childhood trauma to a long list of mental conditions, including psychosis.^{101 102 103} In one large study, individuals with three childhood

adversities were 30 times more likely to be diagnosed with a psychotic disorder than those without. A recent meta-analysis shows that if six types of childhood adversity were eliminated, a third of new psychosis cases could be prevented.¹⁰⁴ The evidence for this link is so strong that numerous researchers are now arguing for a potential causal connection. The “traumagenic neurodevelopmental model”¹⁰⁵ is consistent with findings on toxic stress reviewed earlier. This theory suggests that changes in the brain caused by childhood trauma result in the heightened sensitivity to stress often found in people diagnosed with psychotic disorders, including schizophrenia. While genetic factors underlying individual vulnerability still come into play,¹⁰⁶ a wide range of studies support the notion that adverse life events play a major role in the development of mental disorders.¹⁰⁷

Research has also confirmed strong links between childhood adversity and alcohol use,^{108 109 110 111} tobacco use,^{112 113 114} and illicit drug use.^{115 116} In some studies, exposure to trauma in adulthood also increases risk for substance use.¹¹⁷ These findings leave little doubt that severe childhood adversity places an individual at life-long risk of substance abuse, and that addictions are experience-dependent as well as substance-dependent. Acknowledging multiple causal factors and pathways to addiction may ultimately lead to more effective treatment as well as prevention programs.

The relationship between childhood adversity and suicide is equally strong.^{118 119 120 121 122} A recent meta-analysis concluded that people with histories of child abuse are three times more likely to attempt suicide than those with no abuse history.¹²³ All forms of adversity appear to increase risk, but childhood sexual abuse is particularly predictive.¹²⁴ Stressful life events and trauma in adulthood also increase the likelihood of suicide.^{125 126} Many questions remain about the interaction of risk factors, but several recent studies show childhood adversity and adult trauma interacting to further increase risk of suicide.^{127 128} Some suicide researchers are beginning to explore genetic and biological factors that may mediate the relationship between trauma and suicide risk,^{129 130 131} as well as potential protective factors.¹³² While there is clearly more work to do, the research evidence linking suicide to traumatic experiences is strong and has significant policy implications.¹³³

Evidence is growing that “chains of risk” are at play, with one risk factor increasing the likelihood of additional factors. For example, many women Veterans have histories of child abuse, which increases the likelihood that they will experience military sexual assault and intimate partner violence, which in turn amplify the existing risk for behavioral health problems and suicide.¹³⁴ Several studies have confirmed that multiple adverse childhood experiences increase the likelihood of PTSD in combat Veterans over and above the level of combat exposure.^{135 136} These results support the developmental cascade model described earlier, and highlight the importance of considering pre-enlistment traumatic experiences as well as combat exposure in the treatment of military personnel.

Being a victim of violence is also closely linked to prior trauma and childhood adversity. Victims of interpersonal violence – whether children or adults – are often re-victimized. Research has consistently shown that childhood trauma significantly increases the likelihood of adult intimate partner violence.^{137 138} Similarly, sexual assault in childhood or adolescence increases risk of sexual assault as an adult, for both men and women. Estimates of increased risk range from 2 to 13.7-fold, depending on gender, use of physical force, type of assault, and age at assault.^{139 140} There are many possible psychological explanations for re-victimization.¹⁴¹ Several of these, including changes in affect regulation and ability to identify danger, may relate directly to the neurobiological impact of toxic stress. Other trauma-related problems in adulthood, such as substance abuse or psychiatric disorders, also increase vulnerability.^{142 143} This is another example of a chain of risk which, in many cases, may be initiated by toxic stress and trauma in childhood.

Toxic Stress

Violent experiences in childhood significantly increase the risk of perpetrating violence as an adult. The ACE study^{144 145} and others have shown a strong relationship between child abuse (including witnessing domestic violence as a child) and adult interpersonal violence (IPV) perpetration, although not on all measures¹⁴⁶ and sometimes differing by gender.^{147 148} Researchers have begun to explore a number of potential mediating factors.^{149 150 151 152 153} They are also looking at how child and adult trauma experiences interact. One study found a significant “stress sensitization effect,” where adult stressors increase risk for IPV perpetration most strongly in people with histories of childhood adversity.¹⁵⁴ A growing body of research also suggests that trauma histories are a risk factor for other forms of violence, including murder.^{155 156 157} One study found that child abuse increases the risk of criminality by 50%.¹⁵⁸ Understanding the neurophysiological impact of trauma and toxic stress can help us to develop better models of violent behavior.^{159 160} Longitudinal research combining physiological and psychological methods would be helpful in identifying pathways through which biological functioning contributes to violent behavior.

Toxic stress and trauma also appear to be related to economic outcomes. The ACE study found that childhood adversity was strongly related to impaired job performance, absenteeism, and serious financial problems in an employed population.¹⁶¹ Several more recent studies, including two using very large databases, have found a strong and significant relationship between ACEs and unemployment.^{162 163 164} Several studies have also demonstrated a link between childhood adversity and homelessness, particularly with multiple sources of trauma.^{165 166}

Summary

It is clear that for both adults and children, exposure to toxic stressors has profound and wide ranging impacts on all important aspects of life. For children, toxic stress leads to developmental problems in learning and language, which are followed by predictable problems in school. Failure in school, coupled with emotional and regulatory problems, increases risk for behavioral health disorders, including the use of substances. Educational difficulties foreshadow occupational difficulties, which in turn depress socio-economic status and increase stress in adults and in their children. If unaddressed, this developmental cascade continues throughout adulthood. Childhood adversity increases the likelihood of violence and trauma in adulthood, which further compromises health and social outcomes. Poor health and social outcomes, in turn, create conditions which put the next generation at risk.

This brief review makes a compelling case for the developmental antecedents of our current major health and social problems. The implications for policy and practice are profound. Preventing or reducing sources of trauma and toxic stress in both childhood and adulthood would have widespread ripple effects across society. Public health, safety and economic security would likely all be affected. Increasing resilience in children and adults would lessen the impact of trauma and toxic stress and could help to break the chains of risk. Intervening in ways that address the underlying causes of health and behavioral health problems would not only help people regain their lives, but might well help to break intergenerational cycles of stress-related problems. Fortunately, we’ve learned much about what can be done to prevent the cascade and improve population health.

Resilience

Resilience is the capacity of all individuals to maintain positive mental health and avoid behavioral health problems despite the presence of toxic stress and adversity.^{167 168} Although everyone is exposed to stress and nearly 90% experience some sort of trauma in their lifetime,¹⁶⁹ most individuals overcome the adversity and do not develop health or behavioral health problems.^{170 171} Meta-analyses

demonstrate that on average, only 20% of adults who experience severe traumatic stressors develop PTSD.¹⁷² According to Masten, resilience is "the capacity of a dynamic system to adapt successfully to disturbances that threaten system function, viability, or development."¹⁷³

Once thought of as an innate competency that people either had or lacked, we now approach resilience as a basic human capacity that can be developed and strengthened.¹⁷⁴ It is influenced by genetic factors, resources in the environment, and the attitudes and skills that are acquired at various stages of development.¹⁷⁵ Resilience can only be assessed when a person is exposed to stress or adversity. However, it is not solely a coping mechanism to deal with adversity but also a positive trait, helping an individual experience positive mental health during times of stress or trauma.^{176 177} Resilience at the time of a traumatic event appears to be related to having a supportive social environment and a malleable personality schema.¹⁷⁸ Resilience is often considered central for children and adolescents to become successful adults. The earlier individuals develop competencies the more successful they will be, since successfully addressing one challenge increases the likelihood of future success.^{179 180 181 182} For example, a child who overcomes adversity to graduate from high school is less likely to face challenges in employment and financial stability. However, resilience is a changing and modifiable process of adaptation.^{183 184} Adults, even with difficult histories, can become more resilient through positive environmental influences (e.g., good friends, supportive spouse, safe neighborhood).

Protective Factors and Competencies

Protective factors in the individual's biological, emotional, cognitive and social environment help increase resilience. Resilience is enhanced when these protective factors are strengthened through everyday interactions and targeted interventions.^{185 186} Individual characteristics, family conditions, and community supports are three resources that together help build resiliency.¹⁸⁷ Protective and risk factors interact with one another in developmental cascades to promote or inhibit resilience.^{188 189 190}

Individual and Family Characteristics. A number of individual and family characteristics promote resilience. Characteristics that have been identified in the literature include healthy attachment to caring adults, effective parenting, problem solving skills, self-regulation, perceived efficacy, motivation, friends/partners, hope, autonomy, belief that life has meaning or purpose, and effective teachers.^{191 192} Family conditions that contribute to resilience include parents who are responsive, supportive, and provide firm boundaries but are not controlling. The family structure, positive relationships between parents, family cohesion, stimulating environments, social support, and adequate income also help provide an environment where individuals thrive.¹⁹³

Community supports also contribute to healthy families and individuals. Factors that optimize resilience include safe neighborhoods, support services, prevention programs, access to health services, economic opportunities, and civic, religious and spiritual organizations.^{194 195} Environmental factors overlap with community supports and include safe communities; peace (absence of war); moderate income communities; safe, resourced schools; clean, walkable neighborhoods; parks and green space; and clean air and sanitation.¹⁹⁶

Resilience in adults. Resiliency research and interventions have been primarily aimed at children and youth. However, adults may also increase competencies that enhance resilience.^{197 198 199} The U.S. military has developed resilience training to help mitigate the effects of trauma and adversity experienced during deployments. Before, during, and after deployments, service members participate in interventions to help enhance resilience with the hopes that it will prevent long term problems related to trauma, family disruption, and other issues encountered during combat.^{200 201} In addition, there is a growing body of research testifying to the positive psychological changes that can, under

some circumstances, result from people's struggles with adversity.²⁰² While many questions remain about how these changes occur, "posttraumatic growth" provides a concrete illustration of the inherent resilience of the human psyche.

Resilience at different ecological levels

For individuals, resilience is the ability to adapt under varying circumstances and the ability to return to equilibrium after a challenge or traumatic event. For communities, resilience is demonstrated by the ability to come together to address problems and then return to business as usual. At the societal level, resilience is the ability for the social infrastructure to withstand stress. Overall, resilient systems are activated when they encounter adversity. Resilient systems attempt to identify and understand the threat, respond effectively, and return to healthy functioning.²⁰³

Summary

Understanding the mechanisms and processes that create resilience in individuals and communities is key to developing preventive and restorative interventions. Resilience is enhanced by personal characteristics but can also be strengthened or damaged by experiences. It is developed through successful negotiation of stressful situations and is most clearly exhibited in the presence of stressors. Environments which permit experimentation and reinforce effort as well as accomplishment promote resilience. So do environments which promote flexible emotional responses to adversity. Several of the preventive interventions to be discussed below capitalize on these strategies.

Prevention Programs and Policies

It is clear from our review of toxic stress that prevention programming should begin before birth and continue through the life course. Specific strategies should target risk factors and developmental challenges encountered at each life phase. This approach is consistent with the comprehensive 2009 Institute of Medicine review of prevention and promotion.²⁰⁴ Here, we will selectively update that review using a developmental framework. We will also use an ecological perspective, focusing on the level of the intervention – individual, family, community and more general social policies.

Early Life Influences

The work of Shonkoff and his colleagues at the Harvard Center for the Developing Child is particularly helpful in identifying the needs of developing infants and their families.²⁰⁵ They highlight interventions that are principally targeted at vulnerable populations, but that should be available to everyone. Programs and supports should assure access to:

- Basic medical care for everyone, but especially for pregnant women and their children,
- Early and intensive support for vulnerable families by skilled home visitors,
- Participation in high quality, center-based early education programs,
- Programs that provide direct support to reduce the frequency of toxic stressors (e.g. abuse, parental substance abuse, parental mental illness),
- Work-based income supplements to assure adequate financial resources, and
- Reduction of neuro-toxins.

A variety of evidence-based programs can provide these needed services and supports. Perhaps best known and most extensively studied is the Nurse Family Partnership (NFP). In this program, low income, first time mothers receive visiting nurse services throughout their pregnancy and for the first

two years postpartum. Longitudinal, randomized trial data indicate a broad range of positive effects on both the mother and the child through young adulthood. Effects include reduced levels of child abuse and less reliance on public assistance for children whose mothers were served in the intervention.²⁰⁶ Appreciating the long term benefits of visitation programs, the Department of Defense, as part of their efforts to support military families, offers home visitation through the new parent support program.²⁰⁷ Several other evidence-based home visitation programs have been studied as well, and characteristics of successful programs have been identified.^{208 209 210}

Quality programs. Quality, early childhood educational programs can have long term benefits. Among the best known of these is the Abecedarian Project. The strongest effects of the program are for the early childhood component (age 0-5) which emphasizes cognitive and social stimulation, caregiving and supervised play. A recent paper documents *adult* health outcomes associated with the experimental condition.²¹¹ Participants in the experimental program have significantly lower risk factors for heart and metabolic disorders in their mid-30s.

Early childhood education programs, such as early head start, have also been shown to be effective in improving both short and long term developmental outcomes. The strength of effects is dependent on the quality of the programs. Low income children are particularly sensitive to variations in quality.²¹² Quality includes dimensions such as the preparation of teachers, small class sizes, age appropriate curricula and warm/responsive interactions.²¹³ Large variation in quality among existing programs is a concern.

Parent education. While the home visitation services involve support and education of parents in child care and development, a large number of prevention programs focus on behavioral and cognitive behavioral techniques in parent education. A recent Cochrane review found that these interventions improved parental mental health and parenting skills, and were associated with a significant reduction in childhood conduct problems.²¹⁴ The review included programs like Triple P (Positive Parenting Program).²¹⁵ Triple P is a prevention program that has both primary and secondary prevention components, including a universal intervention. A meta-analysis showed Triple P to have medium to large effects in reducing child and parent problematic behaviors and improving parenting skills.²¹⁶ It has also been shown to reduce rates of child maltreatment and out of home placement at the county level.²¹⁷ Research has also demonstrated the effectiveness of several other programs. The Strengthening Parents intervention reduces the likelihood of substance abuse, improves school performance and coping, and reduces internalizing disorders.²¹⁸ The Incredible Years program increases child independent play, reduces child problem behavior, increases positive parenting and enhances parent confidence.²¹⁹ The American Psychological Association developed and supports the Adults and Children together parent education program that focuses on early violence prevention. It has been demonstrated to impact several aspects of positive parenting, including a reduction in harsh discipline and an increase in nurturing parenting behaviors..²²⁰

Parental mental illness and substance use. Children who are reared in households with parents who have mental health or addiction disorders are known to have increased risk for developmental problems. Identifying and effectively treating these parents can reduce the likelihood that children will be adversely impacted. In 2009 the Institute of Medicine documented developmental problems associated with untreated parental depression and summarized several strategies that can be used to support maternal mental health and improve child outcomes.²²¹ A 2012 review of selective prevention programs for children from substance affected families identified school, community and family-based interventions aimed at improving child outcomes for non-substance involved children. Interventions showed benefits to parental knowledge, coping skills and family relations. These

impacts were more pronounced when programs lasted longer than ten weeks and involved parent and family skill training. However, the lack of longitudinal data and limited number of studies makes the conclusions tentative.²²² Assuring access to care for parents with behavioral health disorders in order to reduce the adverse consequences for children is an important preventive strategy. Also important are interventions to reduce family violence, child abuse, etc.

School Based Interventions

Given the amount of time that children spend in school, school-based prevention programs make good sense. Mendelson and colleagues' review indicate that these programs improve youth development and decrease problem behaviors.²²³ The Good Behavior Game is designed for early elementary settings. It uses a game structure to reinforce desirable individual and group behaviors. The program produces immediate benefits in classroom management and student participation.²²⁴ It also leads to long term benefits. At 13 year follow-up, individuals served in the experimental condition had a 36% lower rate of special education placements, improvement in reading and math skills, a 21% increase in high school graduation, and a 61% increase in college attendance. At 19-21 years of age, males were 50% less likely to be drug involved, 60% less likely to smoke, and 35% less likely to meet criteria for antisocial personality disorder. Both males and females were 35% less likely have abused alcohol.²²⁵

The Seattle Social Development Project is a multi-component universal prevention program designed for elementary school. Curricula for teachers, students and parents are designed to promote children's active involvement in the classroom and home. Both accomplishments and effort are rewarded. As with the Good Behavior Game, the intervention showed positive effects and long term benefits. At 15 year follow-up, young adults who participated had better educational and occupational outcomes, reduced rates of mental illness diagnosis and safer sex practices.²²⁶

Positive Behavior Intervention and Supports Program (PBIS) is a framework for school-wide implementation that employs positive behavioral learning concepts. It uses a universal prevention intervention to set expectations for behavior that are consistently measured and reinforced. PBIS also includes selected and indicated prevention techniques depending on students' needs. PBIS has a wide range of positive outcomes, including improving classroom management and organizational climate and reducing suspensions and disruptive behavior. It improves academic achievement through improved concentration, emotional regulation and prosocial behavior.²²⁷ PBIS has also been shown to reduce bullying and peer rejection.²²⁸ PBIS is attractive to school administrators and has been adopted in an estimated 10,000 schools in 45 states.²²⁹

Community Wide Interventions

Community-wide interventions are intended to respond to community risk factors through organized community-based efforts. Community Anti-drug Coalitions are an excellent example. They use a well-developed community problem-solving framework that has been shown to increase the effectiveness of community coalitions.²³⁰ The model uses the SAMHSA Strategic Prevention Framework (SPF)²³¹ as an organizing construct.²³² CADCA utilizes seven strategies for community change that are part of the University of Kansas' Community Toolbox, a resource for various aspects of the community change process.²³³ The seven strategies utilized by CADCA coalitions for community change are providing information (i.e., public education), enhancing skills (i.e., trainings, technical assistance), providing support (e.g., alternative activities, mentoring, support groups), enhancing access and reducing barriers to services and supports, changing consequences (i.e., providing incentives and disincentives for behaviors), physical design (i.e., changes in physical environment), and modifying/changing

policies (e.g., law enforcement procedures, systems change).²³⁴ Community coalitions represent a key piece of public health infrastructure that can help assure the quality and sustainability of prevention activities.

The Communities that Care Program(CTC) also utilizes community coalitions and a planning framework compatible with SPF. CTC helps communities to identify risk and protective factors and to select appropriate evidence-based programs. Results of a multi-site trial of the CTC framework indicate that it has been successful in reducing the incidence of alcohol, cigarette and tobacco use as well as reducing the level of delinquent behavior for 5th-8th grade students.²³⁵

The PROSPER program engages communities with university partners. It uses the agricultural extension service to assure high quality implementation of selected prevention programs. As with SPF and CTC, PROSPER involves community needs assessment and selection of prevention strategies that map the assets and challenges of the community. Research results indicate that it is associated with reduced substance use initiation, reduced use of marijuana and inhalants and trends toward lower alcohol and cigarette use. Interestingly, high risk students seemed to profit more from the program than low risk students.²³⁶

Violence prevention efforts address a powerful neighborhood risk factor. Cease Fire, a community intervention in Chicago, uses multiple strategies to reduce violence. Strategies include documenting the costs of violence, changing community norms about violence, and providing of alternative dispute resolution. The program was successful with high risk individuals who had poor academic achievement and an arrest record. Program participants were more likely to achieve vocational and educational goals. The overall level of violence was also reduced in participating neighborhoods.²³⁷ The program has been replicated in Baltimore, where neighborhoods with the best implementation were most effective in violence reduction.²³⁸

Safety in housing is another important factor in risk reduction. While the literature is clear regarding the impacts of unsafe housing on health,²³⁹ voucher programs that allow families to move from unsafe neighborhoods have had mixed success in improving the health of residents.²⁴¹ A Chicago-based program was accompanied by better educational achievement for children who were involved,²⁴² although mothers' adjustment to the move was difficult.²⁴³ Longitudinal follow-up of individuals whose public housing was demolished and who were subsequently relocated in Atlanta showed improvements in substance abuse and depressive symptoms.²⁴⁴ ²⁴⁵ The improvements in housing associated with these moves have also been linked to marginal improvements in economic conditions. However, moving caused important social disruptions that are associated with deteriorating health and mental health.²⁴⁶ Considering the social and psychological impact as well as the degree of improvement in economic and housing conditions is critical for understanding the impact of housing interventions on well being.

Policy Interventions

Social and community policies are also important strategies for promoting health. At the state level, tax policies have been demonstrated to reduce the levels of alcohol consumption. Meta-analyses reported by Wagenaar and colleagues found that higher taxes were associated with lower consumption.²⁴⁷ In other work they estimated that doubling the alcohol tax would reduce traffic deaths by 11%, alcohol related deaths by 35%, sexually transmitted disease by 6%, as well as violence and crime.²⁴⁸

At a more macro level, social insurance policies that provide greater social and economic support to individuals and families can help to reduce the prevalence and impact of poverty, stress and trauma. More permissive family leave policies can make parent/infant bonding more effective. Income support or supplements for working parents in low wage jobs can be beneficial. So can other policies that help to assure a basic standard of living and access to health care.²⁴⁹ Economic development policies can also be effective in reducing community violence. Recent work funded by the CDC suggested that investment in business improvement districts are associated with a 12% decrease in robbery, 8% drop in violent crime and a 32% drop in arrests.²⁵⁰ As the World Health Organization notes, mental health promotion is largely socio-political. Activities that can make an impact include reducing unemployment, improving schooling and housing, and reducing stigma and discrimination.²⁵¹

NREPP Interventions

A search of the NREPP data base for 'primary prevention' interventions resulted in 23 evidence-based interventions being identified. Of these, two treatment programs were misclassified as prevention and the Good Behavior Game, which is represented on NREPP, was not included on the list. Therefore, at least 21 evidence-based interventions have been reviewed and are available on NREPP.

The majority of the interventions (14 of 21) are school-based. They typically address school related behaviors, substance abuse and mental health outcomes, and social adaptation to school. As such, they represent many of the content areas addressed in our discussion of school based interventions. Three interventions focused specifically on parenting skills. These were designed to increase the parental effectiveness and confidence as well as to promote bonding between parents and children. Two workplace interventions are included in the NREPP: one that addressed stress management in the workplace and one that was specifically concerned with suicide prevention. The latter is the QPR intervention which can be used in multiple settings. The remaining interventions were appropriate for other community settings and addressed the prevention of a variety of behavioral health problems and prosocial behaviors.

Interestingly, no social policy interventions were identified in the search in the NREPP.

Summary

This brief and selective review of the prevention literature builds on the important work of the Institute of Medicine. Research clearly demonstrates that we have a wide variety of evidence-based prevention programs and policy initiatives that can be implemented in different settings. These interventions have been shown to reduce exposure to toxic stressors and increase protective factors. Both are associated with improved health, mental health, productivity and overall wellbeing. Given our concern with contemporary problems in human capital and deteriorating health status, the strength of the science is encouraging. These results should help to build a compelling case for national efforts to assure that this science is systematically applied throughout the United States.

Evidence-Based Interventions

Addressing the impact of toxic stress and trauma on the development of health and social problems will require a far more integrated approach to intervention than we have currently put in place. Problems faced by adults can no longer be seen in isolation from what happened to them earlier in life. Medical problems can no longer be treated without considering the stressors that contributed to their development. In a public health approach, health problems become social issues and social

problems become health issues. Effective treatment becomes prevention of problems in the next generation.

In this section, we use a public health framework to review evidence-based interventions for trauma-related behavioral health disorders. What quickly becomes obvious is that behavioral health treatment is largely based on a medical rather than a public health model. Treatment is usually aimed at reducing symptoms or improving people's lives by changing thoughts, emotions or behaviors. Patient education and supportive interventions are sometimes considered separate or secondary concerns. A public health approach maintains the focus on treating the individual's immediate concerns, but also may examine why the symptoms developed and consider ways to reduce risk of additional trauma. Similarly, the individual is not seen in isolation, but in the context of significant others and the environment.

The shift in framework presented in this paper poses new challenges and opportunities for clinicians and clinical researchers. Many clinical interventions and research studies have been based on specific categories of psychiatric disorder rather than underlying causal factors. The assumption has been that people with a common psychiatric diagnosis will, in general, benefit from the same forms of treatment. But we now know that behavioral health disorders can have different and/or multiple causes. As the director of the National Institute of Mental Health recently pointed out, it appears that what we currently call "schizophrenia" may be a cluster of different disorders with different trajectories.²⁵² It is quite possible that people whose disorders have different causal pathways or trajectories may respond differently to different treatments. If the problem is directly related to a traumatic experience, the specific circumstances of that trauma may have important treatment implications. These issues have recently begun to be explored. For example, a new therapeutic intervention to assist suicidal individuals who have had traumatic experiences is currently being tested.²⁵³ The evidence reviewed in this paper suggests that this is an important direction. Adults diagnosed with psychosis who have trauma histories show a more severe clinical profile than those without such experiences. They also have worse overall functioning and lower remission rates.²⁵⁴ Will those individuals with histories of severe child abuse respond in the same way to a specific treatment as those without? Will people who use substances have a harder time abstaining if their substance use is related to childhood adversity? The argument put forth in this paper suggests that ultimately it may be possible to use information about life course events to help tailor individualized interventions.

Trauma-Related Interventions in NREPP

SAMHSA's National Registry of Evidence-based Programs and Practices (NREPP) lists 339 evidence-based programs for treating mental health and substance abuse conditions in adults and children. NREPP is a searchable online database of interventions that have met NREPP's minimum requirements for evidence of effectiveness. NREPP provides only a partial list of what's available, since it relies on voluntary submissions. When searches of NREPP are done using the keywords PTSD, PTSS and Complex Trauma, a total of 18 programs are identified (across all age groups). A search using the outcome category "trauma/injuries" yields 24 programs. Adding the two groups of search terms together and eliminating duplication yields a total of 31 evidence-based, trauma-related programs - a fraction of the total number of treatments available.

It is encouraging that evidence-based treatments exist. However, the small number of interventions explicitly addressing trauma illustrates the need for a fundamental shift in thinking. The research reviewed in this paper demonstrates that a sizeable percentage of people in treatment for behavioral health issues are there in part due to toxic stress as children and/or trauma as adults. They may not identify as "trauma survivors," and in fact may be unaware of the link between their life experiences

Toxic Stress

and their current problems. Treatment providers also may not make the link. Until very recently, “trauma-related issues” were considered a separate category of behavioral health problem – sometimes co-existing with other disorders, but seen as etiologically distinct. As this distinction begins to dissolve, we are likely to see a wave of new treatments and new applications of established interventions.

Evidence-based Trauma-Related Treatments in Children

The NREPP database lists a number of evidence-based trauma treatments for children and adolescents. Reviews of treatment effectiveness indicate that several different therapies are effective for up to a month following treatment. There is no clear evidence that children with particular types of trauma are more or less likely to respond to different therapies.²⁵⁵ A number of studies suggest that TF-CBT is the best-supported treatment for reducing symptoms of PTSD in children and adolescents with trauma histories. Therapeutic interventions developed specifically for children with complex trauma, such as the Attachment, Regulation and Competency (ARC) model, have also demonstrated positive outcomes. The evidence concerning behavior problems and depression is less clear.²⁵⁶

Given the apparent effectiveness of TF-CBT with children, clinicians and researchers are beginning to explore ways to enhance access and engagement in services. One modification uses a “stepped-care” model, where patients are monitored for improvements and treatment ends as soon as improvement occurs. These models are often more convenient for clients and may improve treatment adherence.²⁵⁷ Another modification supplements TF-CBT with evidence-based engagement strategies. One study found that participants who received TF-CBT plus engagement were less likely to drop out of treatment prematurely.²⁵⁸

Evidence-based Trauma-Related Treatments in Adults

Treatments for adults with trauma histories fall into two basic categories. A number of therapies address Posttraumatic Stress Disorder (PTSD); its precursor, Posttraumatic Stress Symptoms (PTSS); and/or the constellation of multiple traumatic experiences diagnosed as Complex PTSD. A second group of therapies are designed for people with substance abuse and/or mental health disorders who also have identified trauma histories.

PTSD therapies, in general, are effective in symptom reduction. A meta-analysis found that on average, the approaches tested produced improvements. However, the majority of patients continued to have residual symptoms.²⁵⁹ Another review examined therapies previously identified as effective. This review concluded that evidence is strongest for Eye Movement Desensitization and Reprocessing (EMDR) and variations of Trauma-Focused Cognitive Behavioral Therapy (TF-CBT). Non-trauma-focused psychological therapies did not reduce symptoms as significantly.²⁶⁰ The use of medication for PTSD treatment has also been explored. One review found that significantly more patients responded to medication (59.1%) than to placebo (38.5%). However, no comparisons were made with other forms of treatment.²⁶¹ Clinical guidelines often suggest using a combination of medication and therapy, but there are too few studies to draw conclusions.²⁶² Research on the treatment of acute traumatic stress symptoms suggests that TF-CBT may be helpful, but the findings are inconclusive.²⁶³

Clinicians and researchers have long recognized that people with behavioral health disorders often come from traumatic backgrounds and have multiple problems.²⁶⁴ Several reviews find that individuals with co-occurring substance abuse and trauma disorders show more severe symptoms and may be more likely to relapse than persons without trauma.^{265 266} NREPP lists a number of interventions addressing individuals with these complex histories. Well-known models include Trauma Recovery and Empowerment Model (TREM), Target, Trauma Incident Reduction, Seeking Safety, the Boston Consortium Model, and Risking Connection. These approaches often involve teaching clients about the relationship between their experiences of trauma and their current problems. They also teach strategies for coping with symptoms and provide concrete assistance with housing, vocational and social goals. A five-year outcome study in ten sites showed that approaches

that integrate trauma, mental health and substance abuse services are more effective than programs that treat them separately. Educational and group components are also important.²⁶⁷ One recent review of treatments for co-occurring substance abuse disorders and PTSD shows positive outcomes on multiple domains. In this review, Seeking Safety was the only treatment model to outperform a control on both PTSD and substance abuse disorders.²⁶⁸ However, research findings have been somewhat mixed.²⁶⁹

New Directions

The field of trauma treatment is changing rapidly. As the impact of trauma is better understood, the field is beginning to re-conceptualize the kind of tools and training needed for effective intervention. Until recently, trauma treatment was considered a narrow specialty. Few mental health professionals were familiar with the neurobiology of trauma or with specific trauma treatments. This situation appears to be changing. A group of 60 national experts recently developed a consensus statement for trauma mental health. They also outlined competencies in the areas of trauma knowledge, assessment, interventions, professionalism and relational/systems. These competencies may be a first step in the future training of a trauma-informed and trauma-competent mental health workforce.²⁷⁰

One of the most promising new developments in addressing trauma is the application of developmental neurobiology to the therapy process.²⁷¹ The Neurosequential Model of Therapeutics (NMT) developed by Bruce Perry uses a multidimensional assessment process to develop a picture of the client's strengths and vulnerabilities in the context of their specific history. NMT identifies key systems and areas of the brain which have been impacted by adverse experiences. It is designed to help the clinician select and sequence appropriate activities based on the specific needs of the client.²⁷² Initial applications of the model have been promising.²⁷³ To date this approach has been used only with children and adolescents, but it has clear implications for intervening with both children and adults. In adults diagnosed with serious mental illness, treatment approaches that address the cognitive and emotional deficits often associated with trauma histories are promising.²⁷⁴

Summary

A public health approach to the epidemics of today requires the integration of prevention and treatment approaches. Effective treatments will not only assist individuals who have already developed problems, but may help to interrupt the chains of risk discussed earlier. Even more importantly, effective treatment has the potential to intervene in intergenerational cycles of violence and trauma. This brief summary of treatment interventions indicates that there is a growing science base related to trauma treatment. This literature continues to mature as the field realizes the importance of trauma and toxic stress in the development of behavioral health conditions

There is nothing inevitable about the impact of trauma. While the research is in its infancy, we need to understand how effective treatment can play a role in a comprehensive public health response to toxic stress. Parental mental illness and substance abuse are risk factors for children. Is this risk reduced if the parent receives effective treatment? Can effective treatment for the impact of adversity in childhood alter the trajectory from learning problems to behavioral disorders and perhaps unemployment as an adult? Our hope is that by summarizing this literature and presenting a life course developmental epidemiology, we will stimulate the development of strategies at the federal, state and local level to implement effective solutions as they are discovered and validated.

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