USING NEAR SCIENCES TO ADDRESS COMMUNITY HEALTH: A PRIMER

Abstract

Many communities experience high rates of risk factors that can impact life-long health outcomes. The NEAR sciences (neuroscience, epigenetics, adverse childhood experiences, and resilience) can help prevention practitioners within and outside of Extension understand how to address these risks using approaches like trauma-informed care and building protective factors in at-risk communities. Collective impact groups can network to provide wrap-around supports and services to communities and families. Kitsap Strong, a collective impact program in Kitsap County, is an example of a network utilizing NEAR sciences and trauma-informed care.

Introduction

The connection between an individual's health and the place in which they live, work, and play is deeply rooted in how communities are built and the historical and current socio-economic conditions and policies influencing their daily lives. Environmental factors, such as restricted access to transportation, outdoor recreation, or culturally-appropriate fresh food can, over time, contribute to a lack of physical activity and poor nutrition (Gordon-Larsen et al. 2006). Family and household factors like intergenerational poverty, addiction, or child maltreatment can lead to isolation, stigma, and mental health disorders (Samaan 2000). Institutions can be insensitive to the needs of individuals, creating a spiral of challenging circumstances, isolation, and frustration (Carrillo et al. 2011). Eventually, behavior patterns can lead to substance abuse, obesity, and high blood pressure that can further lead to chronic diseases, such as heart disease and stroke (Felitti et al. 1998).

Prevention in community health not only includes implementing research-based education but it can also mean transforming how local agencies and organizations create policies, systems, and practices. Failures from outdated systems that place shame, blame, and fault on adults for a childhood that they "never asked for" can be compounded by the community's particular response to their survival behaviors. For example, mental health practitioners observe common responses to trauma, including unprovoked aggression, fear of certain types of people, or self-harm (van der Kolk 2014). Often, the triggers of these responses are difficult to identify and understand even for trauma survivors themselves. Conducting internal work within local health, education, and social service agencies to become trauma-informed is a first step towards promoting equity within health systems.

The "NEAR" Framework

NEAR integrates neuroscience, epigenetics, adverse childhood experiences, and resiliency (Porter et al. 2016). These disciplines are combined to address social, educational, and equity issues using science-informed approaches. The NEAR sciences are often grouped during workshops and classes offered to educators, social service providers, and policy makers at the local level, in order to help providers understand how to improve their services, systems, and human interactions to better support community members. NEAR describes how physiological, genetic, and social systems interact to shape individual strengths and needs. A brief overview of each of the disciplines within NEAR follows.

Neuroscience

Neuroscience is a quickly developing field, and recent research in neuroscience has revealed hidden truths about the nature of the brain and what humans need to thrive (Languis et al. 2012). For example, neuroscience has increased our understanding of how humans respond to immediate threats and prolonged stress through the release and use of cortisol in the stress-response system (Nestler et al. 2008). During the stress response, executive functioning can shut down, leaving the individual in "flight or fight" mode and ill-prepared to make complex or healthy decisions.

While prolonged exposure to stress can be toxic due to the physiological effects of cortisol, adrenaline, and glucose in the

body, social relationships help to moderate the stress response and calm the nervous system (Coan et al. 2006). Trusting relationships serve to reduce stress and create a brain that is ready and able to learn and grow (Zak 2017). Healthy activities like exercise and mindfulness can help reduce and process toxic stress hormones (Hoffman-Goetz and Pedersen 1994). Diet and nutrition also play an important role in cognition (Bellisle 2004), and specific nutrients like omega-3 fatty acids contribute to healthy brain development in children and adults (Innis 2008). Community factors like poverty, access to education, job availability, and social connectedness all have an effect on the amount of "toxic stress" impacting parents and their children, influencing brain development and health, and educational and career outcomes across the life-span.

Epigenetics

Epigenetics has received much attention since the breakthrough mapping of the human genome (Allis et al. 2015), because it has disrupted the "nature vs. nurture" debate, providing scientific evidence that social contexts can actually impact and alter gene expression. For example, in laboratories, mother rats who lick their young help to express a gene for social interaction and caring, which is replicated when their offspring go on to care for their own young (Champagne 2008). Similarly, holocaust survivors passed memories of their experiences on to their children through epigenetic markers (Yehuda et al. 2016), influencing the physical health outcomes of future generations and lending credence to the hypothesis of "historical trauma." Diet and exercise may also impact how genes are expressed; for example, a multi-generational study in Sweden showed that if a woman experienced famine during her adolescence, her paternal granddaughter (the daughter of her son) had higher risk of cardio-vascular disease (Bygren et al. 2014). Epigenetics shows that the effects of historical trauma are not confined to ancient history, and some catastrophic events, like slavery, colonization, or the Great Depression, continue to influence lifelong health outcomes for future generations.

Adverse Childhood Experiences

Adverse Childhood Experiences, or ACEs, are early experiences in the lives of individuals that are linked to life-long vulnerability to chronic disease, negative social outcomes, and even early death (Felitti et al. 1998). The original ACEs study examined over 17,000 US adults and discovered ten disruptive childhood experiences, including:

- Physical abuse
- Sexual abuse
- Verbal abuse
- Physical neglect
- Emotional neglect
- Witnessing domestic violence
- Household substance abuse
- Household mental illness
- Losing a parent to separation, divorce, or death
- Having a family member who is in jail

Almost two thirds of the study respondents experienced at least one of these ACEs. As the number of ACEs increased in respondents, so, too, did the likelihood of long-term negative social and health outcomes, like decreased educational accomplishment, increased poverty, incarceration, cardiovascular disease, liver disease, mental health disorders, substance abuse, and death. For example, compared to those who had no ACEs, those with four or more ACEs had 2.2 times the odds of smoking, 10.3 times the odds of having ever injected drugs, 1.6 times the odds of having diabetes, 1.9 times the odds of having cancer, and 2.2 times the odds of having heart disease.

These ten experiences identified by Felitti et al. (1998) are known collectively as Adverse Childhood Experiences, and the findings that these **risk factors** are linked to life-long health have been replicated in other studies. For example, the annual Behavioral Risk Factor Surveillance System surveys have found similar trends in a nationally representative sample of over 53,000 US citizens between 2009 and 2014 (Centers for Disease Control and Prevention 2017). Similarly, a recent meta-analysis of 37 studies found that individuals with four ACEs were at increased risk for negative health outcomes; these associations were mild for physical activity, obesity and diabetes and moderate or strong for smoking, substance abuse, cancer, heart disease, sexual risk taking, and self-directed violence (Hughes et al. 2017). ACEs have far-reaching impacts on society. A study conducted in California suggests that during the year 2013, the state's cost from ACEs equated to $10.5 billion dollars in healthcare spending as well as 434,000 disability-adjusted, life-years lost for the 61% of Californians reporting at least one ACE (Miller et al. 2020).

While these ten ACEs are particularly predictive of health outcomes, they are not the only stressful events that can impact individual health. An individual's mental world also has a direct effect on physical health: in a sample of over 15,000 adults, anxiety and depression scores better predicted the incidence of disease and somatic symptoms than smoking and obesity combined (Niles and O'Donovan 2019). Black (2003) suggests that one mechanism for the impact of stress on health may be inflammatory processes that are triggered by the release of stress hormones and lead to diseases like insulin resistance and atherosclerosis (hardening of the arteries). It is clear that an individual's social and emotional well-being are strong predictors of their physical and mental health over the course of their life.

Resilience

Resilience, which studies how processes in the lives of individuals help them to recover from difficult events or stressful situations, contains a growing body of research (Masten 2015) and has identified pathways for individuals and communities to overcome threats from risk factors, like genetic and epigenetic disorders, childhood adversity, and toxic stress. Resilience is supported by internal, family, and community capacities and structures, also described as **protective factors**, which support or enhance individual outcomes. Internal psychological capacities that contribute to resilience include *grit* or stick-to-it-

ness (Duckworth et al. 2007) as well as self-esteem, confidence, and open-mindedness. Brain imaging shows that as we age, our brains remain "plastic," with the ability to form new connections and grow (Holtmaat and Svoboda 2009); therefore, these internal psychological capacities can be built throughout life. Families and social relationships can support resilience by providing material and emotional support (Armstrong et al. 2005). The study of resilience also translates to systems, including community and ecological resilience after natural and human-made disasters, like war or oil spills (Adger 2000).

A **risk and resilience framework** suggests that individuals are protected from risk factors, like poverty or geographic isolation, by protective factors, like caring family, community connections, and supportive schools (Masten 2015). Several intervention and prevention strategies have successfully mitigated risks by increasing resilience in families, children, and communities. For example, a systematic review of universal interventions targeting resilience in children ages 5–18 found 57 studies that showed significant reductions in depressive symptoms, internalizing problems, externalizing problems, anxiety, and general psychological distress (Dray et al. 2017). Effective interventions in Dray et al. (2017) most commonly targeted internal protective factors, including cognitive competence, problem solving and decision making, cooperation and communication, and coping skills.

Best Practices for Applying NEAR in Communities

Developing a resilient and thriving community ecosystem is critical to addressing the lifelong effects of adversity. The NEAR sciences encourage a shift in perspective away from individual behavior change and towards emphasizing relationships, social connectedness, mental health, and structural supports as the root of individual and community wellness. Helping prevention practitioners and educators understand the science behind risk and protective factors is the first, important step in improving education and human services systems to improve life-long health outcomes. The following approaches can also enhance efforts to improve social services and health-focused interventions.

Trauma-Informed Care

Trauma-informed care is an approach that recognizes the presence of trauma symptoms and acknowledges the role that life-long trauma has played (Ko et al. 2008). Effective trauma-informed systems are built around (1) enhancing the sense of safety for program participants, (2) supporting connections and relationships between participants, staff, family, and community members, and (3) managing emotions and improving capacities for self-regulation and impulse control (Bath 2008). Through this three-tiered response, trauma-informed systems can more effectively meet the needs of individuals and communities in caring and compassionate ways.

Policy, Systems, and Environmental (PSE) Change

Approaches utilizing the NEAR framework often focus on policy, systems, and environmental (PSE) change as a fundamental part of health promotion. Some approaches naturally lend themselves to addressing PSE changes using NEAR sciences. Those include **mapping approaches** like *Community Mapping*, which engages stakeholders and researchers in identifying structural supports and barriers in their communities (Parker 2006). *Ripple Effect Mapping* or *Network Mapping* can help identify where strengths and social support networks enhance resilience. Participatory methods like photo voice, peer-interviewing, and Community-Based Participatory Research help researchers engage with participants as community stakeholders, rather than as subjects or clients in research, which can help build agency and reduce intergenerational and historical trauma (Kollock et al. 2012).

Collective Impacts and Support Networks

Several communities in Washington and elsewhere are working to address community health by networking for shared impact. **Collective impact** groups include multi-sector collaborations to improve wrap-around services for agency clients and interdisciplinary approaches to PSE change (Christens and Inzeo 2015; Kania and Kramer 2017). These networks can include members from education, health, social service, government, non-profit, and private sectors and often have goals related to substance abuse prevention, community health, violence reduction, and human rights. Some are supported by top-down approaches. like Washington State Division of Behavioral Health and Recovery's (DBHR) Community Prevention and Wellness Initiative (CPWI) (DBHR 2019); others are locally-driven or grassroots efforts, like Kitsap Strong (Kitsap Community Foundation 2020). The Washington Department of Health has assembled the ACEs and Resilience Community of Practice, which convenes collective impact groups across the state to enhance shared learning of trauma-informed approaches. Collective impact groups, networks, and coalitions can serve their local communities by educating local policy makers, service providers, and community members on NEAR sciences and the benefits of building resilience through trauma-informed care.

Application of NEAR Sciences in Kitsap County, WA

Weaving together an approach to address community health and equity was the driving force to develop an initiative called Kitsap Strong, serving a population of 260,000 in Kitsap County, Washington. Made up of over 40 organizations and agencies and organized into five networks and four committees,

Kitsap Strong was developed through a collective impact process to address the interconnected public health and social challenges impacting Kitsap County residents (Kania and Kramer 2017). Many of the agencies that had been partnering since the early 2000s to address some of these challenges recognized the opportunity to create a network of partners working to improve health outcomes through the application of the NEAR sciences. The networks that comprise Kitsap Strong include Graduate Strong (focusing on educational attainment), Healthy Eating, Active Living (HEAL) network, the NEAR Education network, Thriving Neighborhoods, and the Innovation Network (focused on identifying promising new programs). Through these networks, Kitsap Strong and community partners promote academic achievement, nutrition and healthy lifestyles, and the application of NEAR sciences and trauma-informed care.

Impacts of Kitsap Strong's work include recruiting and training network partners to promote NEAR sciences in schools, social service agencies, and faith-based and community groups. Kitsap Strong offers a NEAR sciences training that is roughly three hours—the ACE Interface (Anda and Porter 2014), a research-based training that covers the NEAR topics. Kitsap Strong has led dozens of educators through a master trainer program to provide ACE Interface, and has provided hundreds of NEAR sciences workshops. Additionally, in Kitsap, over 35 agencies have completed Kitsap Strong's in-depth Collaborative Learning Academy (CLA) in which agency representatives meet monthly for one year to discuss how to implement NEAR sciences and trauma-informed care for their clients. Participants in this process have included family service agencies, homeless shelters, childcare centers, youth mentoring programs, and juvenile justice programs. Other training opportunities that Kitsap Strong has provided include hosting a weeklong SaintA master trainer program to support in-depth learning on trauma-informed care in its partner agencies (SaintA 2020). They have also added questions to Washington's Healthy Youth Survey based on the "science of hope" (Gestel-Timmermans et al. 2010) and are working to create trauma-sensitive schools.

Although the accomplishments of Kitsap Strong have been extensive, the work does not come without challenges. Because the initiators of the collective impact process did not want the process to lead to another community non-profit with a single focus, Kitsap Strong has remained a collaborative effort, with Kitsap Community Foundation serving as its fiscal sponsor and Kitsap Public Health Department providing space. There are limited staff members, and they see themselves as facilitators rather than direct service providers. Therefore, sometimes the efforts of Kitsap Strong seem protracted, because the work relies on participating agencies to step up and initiate programming. Some agencies are more able to do this than others, and networks have found varying success in collective programming efforts.

The focus on collective impact led to the formation of the following committees to provide oversight and support to Kitsap Strong: the Leadership Committee, the Policy Committee, the Funding Committee, the Data Committee, and the Equity Committee. These committees provide the leadership in each of these areas, and, in most cases, members literally provide "buy-in" to Kitsap Strong through financial support to programs and staff. The existence of these committees and the strength of commitment from contributing agencies has been a primary pillar of Kitsap Strong's success.

Extension professionals in Kitsap County have supported Kitsap Strong and its networks through partnership, programming, and capacity-building efforts. They attend network meetings, serve as subject matter experts, as well as engage in research and educational programming alongside network partners. For example, one faculty member supported the development of the HEAL network by providing financial oversight and serving as a group facilitator. Another faculty member served as a research consultant on a youth marijuana prevention and education study for the Kitsap Public Health Department because of relationships built through Kitsap Strong.

Conclusion

Developing a resilient and thriving community ecosystem is critical to addressing the lifelong effects of adversity for those who have experienced high levels of toxic stress in childhood and adulthood. Because ACEs and other sources of "toxic stress" disproportionately affect impoverished and minority communities, a focus on equity in social services and education should be central to community education and development work.

The NEAR sciences framework shows how community and economic disadvantages can work through genetic and neurological processes to impact physical health. By taking a policy, systems, and environmental change approach to addressing these and other health issues using NEAR sciences and trauma-informed care, service providers, policy makers, and community members can improve community health outcomes. A collective impact approach can form the backbone of NEAR sciences initiatives in a community in order to engage service providers and educators across the community to achieve real change. To initiate such an approach, it is valuable to identify key partners, form the "backbone" of necessary leadership and oversight committees, and seek out training and development in NEAR sciences. Financial and tangible support from community partners like United Way, local tribes, or community foundations can support staff, space, and sustainability in these initiatives. Knowledge partners, like Extension agents, can support training, capacity building, and needs assessment initiatives. Together, agencies can work to reduce the impact of adversity and risk and improve health and wellness for the benefit of all community members.

Glossary of Terms

collective impact: A networked group of community agencies or organizations which come together to contribute shared resources and work towards a collective goal in their community (Kania and Kramer 2017).

mapping approaches: Techniques used in data collection, community development, and evaluation projects to engaging participants in creating a visual representation of the community. Some approaches like *community mapping* provide geographic representation to identify important barriers and supports in the community, while *network mapping* and *ripple effect mapping* illuminate the underlying relationships in a community and hidden impacts of a project (Kollock et al. 2012; Parker 2006).

NEAR sciences: An educational framework for describing how neuroscience, epigenetics, adverse childhood experiences, and resilience interact to create positive or negative outcomes in individual health and well-being; used to demonstrate connections between mental health, relationships, community, and life-long physical health outcomes.

protective factor: Factors at the individual, relational, or societal level which support or enhance individual outcomes or buffer individuals against adversity.

risk and resilience framework: A theoretical framework for describing how risk and protective factors interact to produce positive or negative outcomes in individuals. In this framework, factors promoting resilience help to buffer the individual against risk (Masten 2015).

risk factor: Factors at the individual, relational, or societal level which endanger individuals and put them at risk for negative health or developmental outcomes.

trauma-informed care: An approach in working with trauma-impacted individuals that both recognizes the presence of trauma symptoms and strives to promote healing and well-being (Ko et al. 2008).

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