A Framework for Improving Early Access to Nutritional and Mental Healthcare to Decrease the Prevalence of Preventable Diseases in the United States

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

It is estimated that preventing the emergence of risk factors for preventable chronic diseases could decrease their prevalence by as much as 90%, greatly incentivizing this as a major public health goal. There are many forms of prevention, but nutritional changes and better mental healthcare are some of the more effective options. Nutritional changes can help to prevent the onset of many chronic diseases directly and indirectly due to their effect on mental health, whereas improving one's mental health decreases their risk of developing a health problem outside of mental health. Within the framework of actor-network theory, and with consideration for equity as a primary ethical concern, policy analysis and network analysis are employed to explore methods for increasing access to both nutritional and mental healthcare, methods for enabling people to make nutritious choices by making nutrition more accessible and affordable, and methods to destigmatize mental health. The result is a proposed framework for improving nutritional and mental healthcare on the basis that the most impactful and implementable method is educating children and adolescents about nutrition and mental health, and providing them with access to both of these forms of care in schools. By removing barriers to nutritional and mental healthcare, many risk factors for chronic diseases can be avoided, which will significantly decrease the prevalence of preventable chronic diseases that have such a huge social and economic burden on the United States healthcare system.

A Framework for Improving Early Access to Nutritional and Mental Healthcare to Decrease the Prevalence of Preventable Diseases in the United States

Introduction

It is estimated that preventing the emergence of risk factors for chronic diseases such as cardiovascular disease or type II diabetes mellitus could decrease their prevalence by as much as 90% (Greenberg & Pi-Sunyer, 2019; Hu et al., 2001; Stampfer et al., 2000). Given that these two diseases alone cost the United States healthcare system over $670 billion per year, and this cost is only expected to increase, preventing these diseases is in the best interest of the United States healthcare system and economy (American Diabetes Association, 2018; Virani et al., 2020). Nutritional healthcare and mental healthcare are two possible avenues for prevention. The United States healthcare system is a complex, changing network with a large number of relevant actors, so actor-network theory is the best framework with which to analyze it. Within the framework of actor-network theory, this research paper explores the multilayered relationships between nutritional healthcare, mental healthcare, and the United States healthcare system as a whole. This analysis includes the evaluation of methods for improving access to nutritional education and the ability to enact nutritious behaviors, as well as methods for improving access to mental health and for destigmatizing mental healthcare. The hope is that by expanding nutritional and mental healthcare as forms of preventative healthcare, the prevalence of many preventable diseases can be decreased, therefore counteracting the increasing social and economic burden of these diseases on the United States healthcare system. Therefore, nutritional and mental healthcare are forms of preventative healthcare with the potential to have a meaningful impact on the prevalence of a variety of chronic diseases, so improving access to these types of healthcare, especially for children, has the potential to prevent these diseases from occurring on a large

scale. This argument will be explored below first through background information into the current challenges in nutritional and mental healthcare, then the introduction of actor-network theory as the framework through which analysis will occur, and then the utilization of policy analysis to develop a proposed framework for nutritional and mental healthcare programs in schools, with network analysis used to describe how the network of the United States Healthcare System can implement this framework.

Challenges in Nutritional and Mental Healthcare

The United States healthcare system is laden with a myriad of problems, ranging from the fact that millions of Americans are uninsured, to the multilayered effects of structural racism on how healthcare impacts racial groups (Gravlee, 2009). While all of these problems are important and warrant an investigation into potential solutions, this paper will focus on the systemic shift that is needed from a reactive healthcare system to a more preventative one, since preventative healthcare can prevent some health problems from ever occurring for many people, instead of just treating problems after they occur. As an example, Japan has a long pattern of significant investment in preventative medicine (Lock & Kaufert, 2001), which combined with other factors has led them to have some of the best health outcomes, with the oldest population in the world (Kondo, 2014). Focusing on preventative medicine will have an effect on every aspect of the healthcare system, since if the prevalence of illness and disease can be significantly decreased, the overall burden on the United States healthcare system can be decreased as well. This will free up more time and resources to be focused on other issues in healthcare.

There are many forms of preventative medicine, including mental healthcare (Ohrnberger et al., 2017), nutritional healthcare (Centers for Disease Control and Prevention, 2015), exercise

programs (Ackermann et al., 2003), and many public health programs to promote overall well-being (National Center for Environmental Health, 2019). These programs work by preventing people from exacerbating risk factors or living a lifestyle that will put them at a greater risk of developing a health problem. There is also a great need for environmental changes as a form of preventative care since the environment in which one lives has a huge impact on health outcomes, and is a contributing factor to racial and income inequalities in healthcare. Furthermore, preventative medicine can also take the form of blood panels and other workups that can reveal risk factors and guide lifestyle changes to prevent illness and disease. While all of these forms of preventative care are promising and deserving of further study and implementation, the scope of this paper will be limited to nutrition and mental healthcare in particular, and the interaction between the two, since they have a collaborative impact on all aspects of one's health.

What an individual eats has a significant impact on their risk of developing chronic conditions. For example, the Mediterranean diet has been shown to minimize the risk of diseases such as cancer, cardiovascular disease, and metabolic syndrome, due to the bioactive effects of food components of this diet (Di Daniele et al., 2016). Additionally, the field of nutritional psychiatry has been created in light of the emerging effects of diet on mental health, especially mood disorders (Adan et al., 2019), an interaction mediated by factors such as the human gut microbiome, which is influenced by the food one eats and has an effect on mental health (Hills et al., 2019; Malan-Muller et al., 2018). However, although diet is considered a modifiable risk factor for many conditions, one's ability to modify their nutritional behavior is shaped by many social factors such as living in a food desert due to low economic status, or experiencing elevated stress levels, perhaps as a result of poverty or of racism, that may cause overeating.

The barriers to nutritional information and access are numerous, ranging from a lack of easily available and understandable information about how to eat nutritiously to a lack of access to nutritious foods (Velardo, 2015). First, the nutritional education that one receives is minimal beginning from a young age. Students in the United States only receive 8 hours of nutritional education in schools each year, in contrast to the 40-50 hours required to establish actual behavioral changes (Connell et al., 1985; Division of Population Health & National Center for Chronic Disease Prevention and Health Promotion, 2021). Furthermore, even if one has a good understanding of how to act nutritiously, many people do not actually have access to food that is nutritious, or do not have time to make nutritious food. Approximately 12% of the population of the United States faces food insecurity, due to living in food deserts or not being able to afford nutritious food (Brown et al., 2019). Overcoming all of these barriers is crucial to decreasing the prevalence of chronic diseases, since poor nutrition has been linked to chronic diseases such as cancer (Di Daniele et al., 2016). Furthermore, the emerging field of nutritional psychiatry has illuminated the impact of nutrition on mental health (Adan et al., 2019; Sarris, 2019). Researchers (Conner et al., 2017; Dinan et al., 2019; Moreno-Agostino et al., 2019) have found evidence of a link between poor diet and mood disorders such as depression and anxiety (Adan et al., 2019), suggesting that a healthy diet can decrease one's risk of developing a mood disorder.

Furthermore, mental health can greatly influence physical health, so in order to minimize the prevalence of preventable diseases, it is advantageous to improve not only nutritional healthcare but also mental healthcare (Ohrnberger et al., 2017). Mental healthcare in the United States is both difficult to access, particularly for low-income communities (Hodgkinson et al., 2017), and surrounded by stigma. In many different communities and cultural groups, and

therefore in the United States as a whole, mental health problems are extremely stigmatized, as is seeking mental health treatment such as therapy (Mehta et al., 2015). As a result, in order to improve the mental healthcare system in the United States, access to mental healthcare needs to improve and the stigma needs to be decreased if changes are to be made. If mental healthcare can be improved such that the prevalence of mood disorders decreases, then the prevalence of chronic diseases should also decrease, due to the link between the two.

Finally, now that the overall need for greater access to nutritional and mental healthcare has been established, an important ethical consideration when considering access to any form of healthcare is equity, since racial and ethnic minorities face significantly more obstacles to accessing healthcare than do white people (National Academies of Sciences Engineering, and Medicine et al., 2017). There are many disadvantaged groups when it comes to access to healthcare, including racial and ethnic minorities and low-income people, two groups that have significant overlap due to structural racism. As a result, it is crucial that any method to improve access focus more on these disadvantaged communities to achieve equity and minimize racial and ethnic healthcare disparities. The same racial and economic disparities exist in terms of the school resources that students have access to. Additionally, rural schools have fewer mental health resources than do urban schools, so efforts should be made to achieve equity in this respect as well by putting additional resources into these school districts (Moon et al., 2017). One way in which equity is needed is in terms of health literacy, since understanding health and healthcare is crucial in enabling individuals to have control over their health (Velardo, 2015). Furthermore, food deserts and environmental risks are more common in the geographic areas in which racial minorities and low-income people reside, so true health equity will require these problems to be ameliorated as well. However, the scope of this paper will stay limited to

methods of achieving equity by improving health literacy and access to healthcare in terms of nutrition and mental health.

STS Framework and Research Methods

Actor-network theory can be used to evaluate how best to improve access to and education about nutrition and mental healthcare (Cressman, 2009). Actor-network theory is a framework that describes the constantly changing relationships between actors involved in a system (Rodger et al., 2009). However, actor-network theory has been criticized for being subjective in which actors are included, so care must be taken to ensure that the network contains all of the most relevant actors but does not become infinite (Radder, 1992). In this paper, the actors that were selected were those with a direct connection to the United States healthcare system, determined by which actors were most prominent in the body of research related to the health system. The actors will be described throughout the policy analysis below, and their relationships within the network will be described in the subsequent network analysis as a means of explaining how the proposed framework can be implemented. Improving the healthcare system is an incredibly intricate problem, due to the involvement of politics and policies, the economy, cultural and religious beliefs, complexities of the education system in the United States, and more. Actor-network theory allows for the relationships between the various actors of this problem to be analyzed.

The research methods that are used are policy analysis, network analysis, and documentary research methods. Policy analysis is used to evaluate the various relevant policies currently in place and their efficacy, and network analysis is employed to evaluate how new policies could be implemented within existing networks. The policies and other information

found in this research will be organized thematically to give a clear picture of each layer of the multilayered relationship between nutrition, mental health, and physical health.

Policy Analysis

There are a number of possible avenues to address the shortcomings of nutritional and mental healthcare in the United States. For nutrition these include adding grocery stores to underserved areas, promoting healthier foods in stores, allowing nutrition assistance programs to be valid in more stores (Centers for Disease Control and Prevention, 2014), encouraging farmers markets in low-income areas, providing greater transportation options for customers, encouraging clean and regenerative farming to make all foods safer and healthier, and improving and distributing educational resources regarding nutrition. For mental health, possible initiatives include expanded insurance coverage of mental healthcare, expanded mental healthcare access to underserved areas, public campaigns to destigmatize mental health, workplace requirements to provide paid time off for mental wellbeing, and educational programs in schools regarding the importance of mental health and how to get help if needed. While all of the aforementioned methods would certainly have a positive impact on nutritional and mental healthcare in the United States, and should all be implemented to some extent (Benjamin, 2011), it will be argued here that the most impactful and implementable method is educating children and adolescents about nutrition and mental health, and providing them with both of these forms of care in schools.

By educating children on nutrition and mental health from a young age, and providing them with the necessary resources to act nutritiously and in support of their mental health, life-long behavioral patterns can be established. Regarding nutrition, childhood obesity has been

rising for decades, and in 2015 18.5% of children were obese (Hales, 2017). Being obese puts one at a great risk of developing a multitude of chronic conditions, such as diabetes, or cardiovascular diseases, so preventing childhood obesity is essential if the prevalence of these diseases is to be decreased. Obesity can occur as a result of genetics, but is also largely attributable to diet. Therefore, if the food behaviors of children can be influenced to be healthy at a young age, then the prevalence of childhood obesity will decrease, as will the prevalence of numerous chronic conditions (Schwimmer, 2005). Additionally, mental health is also shaped at a young age, so mental health initiatives targeting young people have great potential to prevent mental health problems from ever developing for many (Patel et al., 2007). Furthermore, due to the significant impact of nutrition on mental health, and the impact of both of these types of health on overall health, they should be considered in tandem in order to develop a more comprehensive and effective framework for improving nutritional and mental healthcare (Adan et al., 2019; Di Daniele et al., 2016).

Nutrition Policy Analysis

Schools are an ideal target for improving access to healthy foods, since elementary through high school students consume half of their daily calories while at school (Centers for Disease Control and Prevention, 2015). While the Healthy, Hunger-Free Kids Act of 2010 did improve nutrition standards in schools, improvements are still needed (Centers for Disease Control and Prevention, 2015). However, the areas in which schools are most lacking are in educating students on nutrition and in providing students with access to nutritious food outside of schools. Children are food insecure in approximately 7.1% of households with children, meaning they do not have consistent access to nutritious food (Coleman-Jensen, 2018). While

school breakfast and lunch programs and summer programs providing free meals to students when school is not in session help with this problem, many children are still left without nutritious food at least some of the time, so access must be improved in addition to education about eating balanced, nutritious meals. Doing so will require funding to expand current school food programs and to give all families greater access to healthy foods. This illuminates the significance of actors such as the U.S. government, policies/funding, the U.S. education system, and food suppliers, since they must all interact to make this expansion of school food programs a reality.

A systematic review of nutritional education interventions found that in order for an intervention to be effective and cause actual behavioral change, as well as increase the participants' knowledge and lead to physiological changes, it should be at least 5 months long, should not have more than 3 unrelated objectives, and (Murimi et al., 2017). Interventions based on theories such as the Trans-theoretical Model or Social Cognitive Theory are also more effective, as are interventions with clear, measurable objectives. It is also important with any nutritional education to include information regarding body positivity, to ensure that although healthy eating should be encouraged, students should not be shamed for their weight, body type, or diet, especially since a poor body image can actually negatively impact eating behaviors (Jankauskiene & Baceviciene, 2019). This education should also include information about the risks of eating disorders, since this is an important concern when defining what healthy eating is and is not.

Although this program was relatively short, a study conducted in the Mid-Western United States showed that a nutrition education program encouraging fruit and vegetable consumption and disseminating other nutritional information was effective in changing long dietary behaviors

(Schmitt et al., 2019). The intervention included 131 second graders, was 6 weeks long, used a Cognitive Social Theory approach and included a tasting aspect to help children develop taste preferences for healthy foods. The tastings and education materials were incorporated into fun activities to keep students engaged. The participants showed increased nutrition and health knowledge, as well as increased fruit and vegetable preferences, when compared to the control group, such that students were led to make behavioral changes towards eating healthier foods. The limitations of this study include the small sample size and homogenous population but similar approaches have worked in other environments as well. For example, in Los Angeles, 104 Latinx fourth and fifth graders, 59% of which were overweight, participated in a 12-week nutritional education and gardening program after school, known as LA Sprouts (Davis et al., 2011). For the duration of the study, participants participated in interactive, 90-minute weekly lessons at a community garden to learn about nutrition and gardening. At the end of the program, the participants had increased fiber intake, decreased diastolic blood pressure, and reduced weight gain compared to the control group. This study indicated that a combination of school nutrition education and gardening can not only affect nutritional behavior, but also cause other health effects as a result. In fact, multiple studies have shown that school health education programs that incorporate gardening are successful in improving children's preferences for fruits and vegetables in a manner similar to the first study mentioned above (Morris & Zidenberg-cherr, 2002).

While both examples given here were implemented in the United States on a small scale, other countries have implemented nationwide programs to emphasize nutrition education, such as the Shokuiku program in Japan (Miyoshi et al., 2012). While there are cultural differences that need to be taken into consideration to successfully implement a program that had success in a

different country with different culture and values, it is likely that a similar program would work in the United States as well. Furthermore, the examples given above of nutritional education interventions in the United States span different geographic regions and different demographics, so it is likely that similar interventions will be successful across the country if tailored to specific regional needs.

Mental Health Policy Analysis

Regarding mental health, most mental disorders develop in youth between the ages of 12 and 24, so addressing mental health concerns before mental disorders begin will give children the necessary tools to address their mental health concerns when they do occur, and will likely prevent some mental health disorders from occurring (Patel et al., 2007). Additionally, suicide is a heightened risk for youth, and mental health disorders are a primary cause of suicide, so protecting mental health in young people has potential to decrease suicide risk (Patel et al., 2007). While many of the risk factors for mental disorders will still exist, providing children with the tools to take care of their mental health, and giving them access to mental healthcare from a young age will mitigate the impact of these risk factors and decrease the severity of the outcomes of mental disorders. Furthermore, mental illness in children and youth is correlated with more mental illness in adulthood, as well as decreased employment prospects and increased criminal behavior, so it is crucial to address mental illness at a young age (Sapthiang et al., 2019).

As for why an educational model that includes comprehensive mental healthcare is especially needed for children, pharmaceutical methods of treating mental health in young people have had limited success, so psychosocial treatments such as therapy are needed for this age group in particular (Health, 2005). Schools in particular play a central role in children's

socialization so they are very well poised to implement programs that will greatly affect children's social and emotional needs (Littlefield et al., 2017). Other countries have had success with school-focused initiatives to both decrease risk factors for mental disorders and provide access to mental healthcare, such as the KidsMatter initiative in Australia (Littlefield et al., 2017). There are still challenges to such approaches, since there needs to be sufficient staff and funding to provide mental health resources in schools, but if sufficient funding is provided, and more mental health professionals are trained, then implementing a mental health program in schools has potential to have a major effect on mental healthcare for children and youth. Additionally, providing education about mental health in schools would be necessary both to help students understand what they are experiencing, and to help decrease the stigma surrounding mental health. Less than 1 in 3 people with mental disorders seek mental health treatment (Vidourek & Burbage, 2019). While some don't seek treatment due to lack of access, many don't seek treatment due to the stigma of having a mental health problem. Therefore, it is important that education about mental health includes initiatives to decrease the stigma surrounding mental health, as has been done successfully through programs that improve mental health literacy (Mehta et al., 2015; Milin et al., 2016).

Australia's KidsMatter initiative has had success in improving students' mental well-being and preventing mental illness in many cases (Littlefield et al., 2017). In lieu of an example of an effective nationwide program in the United States, KidsMatter is well-suited to serve as a model for the United States when developing its own similar program. The KidsMatter initiative has a Primary Education program and an Early Childhood program, each consisting of four components: creating a positive sense of community, developing students' social and emotional learning skills by explicitly teaching them these skills and giving them opportunities

to practice them, working with parents and carers, and helping students who are showing signs of or experiencing mental health difficulties. In schools where the KidsMatter Primary Education program was successfully implemented, it was found that the program improved student mental health and wellbeing, reduced mental health difficulties, improved student success in school, improved teacher, parent and carer abilities to address mental health difficulties, and placed an emphasis on mental health in school agendas. The KidsMatter Early Childhood program was found to increase staff confidence in their ability to identify children experiencing difficulties, provide them with care, and know how to refer them to professionals if necessary. A similar program could be implemented in the United States with ease, and similar programs have been tested on a small scale in individual schools, with success, offering further evidence as to why a similar program should be implemented in schools nationwide.

One example of how mental health education is being implemented on a small scale in schools in the United States is a program where mindfulness is used to replace detention in Patterson High School in Baltimore, MD (Gonzalez, 2019). The implementation of this program required the involvement of actors including teachers, students, and a small portion of the U.S. education system. To expand such a program to other schools, the entire U.S. education system would need to institute policy changes, which can be a difficult task, and thus is an important limitation to the widespread implementation of this program. However, were the U.S. education system to embrace this program, it could be implemented nationwide and lead to better outcomes for students, both academically and in terms of their health, based on the evidence that follows. In this program, students learn how to regulate their emotions using mindful breathing techniques and yoga, both of which relieve stress and anxiety that can be associated with mental health problems. The school found that as a result, suspensions were no longer needed, and

average GPA increased by 0.5%, indicating that students were experiencing greater mental health than they would have had they instead been put in detention. This approach should reduce mental health disorders, since better coping mechanisms decrease risk of developing mood disorders, and higher grades tend to be indicative of a decreased risk of developing a mood disorder (Adams & Adams, 1996; Frydenberg et al., 2009). Mindfulness based interventions such as this one are especially promising for use with adolescents, since although cognitive behavioral therapy has been shown to have success in children, they have had limited success for adolescents (Dray et al., 2017). Mindfulness meditation has also been determined to have a significant effect on anxiety and depression, as was found with a systematic meta-analysis of the effects of this treatment in adolescents (Zoogman et al., 2015).

Proposed Framework for Nutritional and Mental Healthcare Programs in Schools

While large-scale policies abroad and small-scale policies in the United States have had success in improving nutritional or mental health for children, a combined policy is needed due to the connections between the two fields. Due to the relationship between nutrition and mental health, it is likely that if education programs for both are combined, then improvements in mental health will result in improvements in nutritional behaviors, and vice versa. According to the field of nutritional psychiatry, improving nutritional health will in many cases help to improve mental health (Marx et al., 2017). Furthermore, since some mental health disorders can lead to dietary changes, improvements in one's mental health will in many cases result in improved nutrition (Bremner et al., 2020), meaning that mental health education and access should aid in the success of any nutritional education and access program, so combining the two should maximize the success of the program. An ideal program would be implemented in the

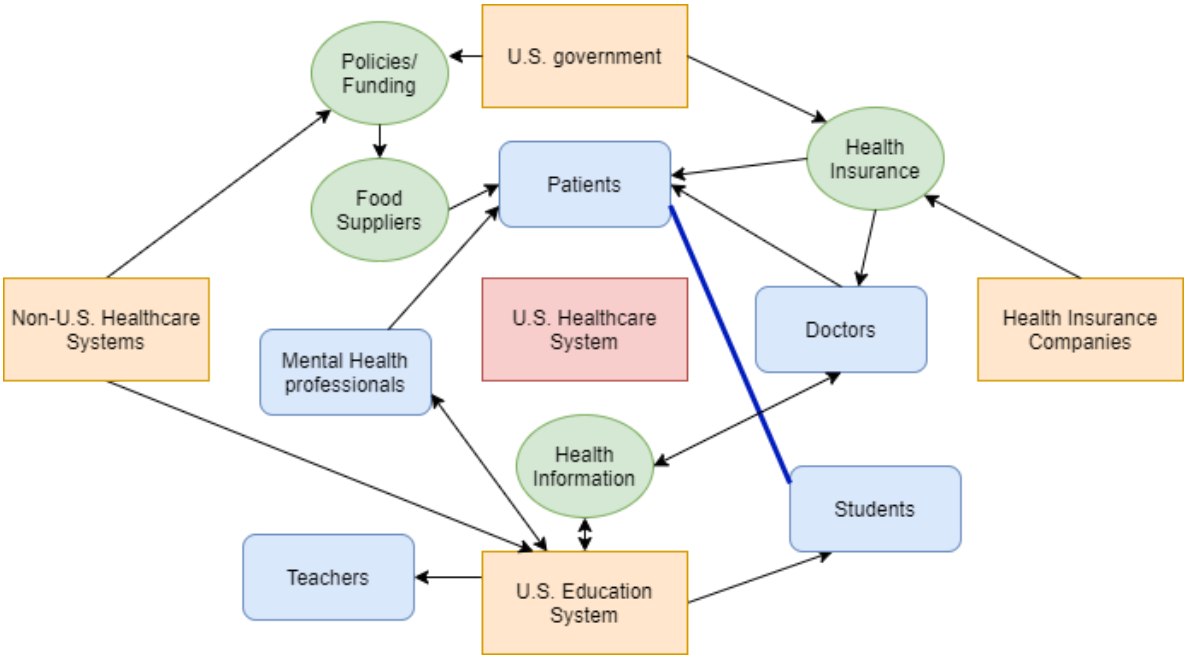
form of a national framework that can be modified as needed based on regional differences Any such program should be implemented in schools, so as to reach all children, and should educate children on both mental and nutritional health, while improving their access to both forms of healthcare. This reiterates the need for ethics to always be central to the development of a new technology, including systems such as the U.S. Healthcare system, since the ethical concern of equity is central to any method of expanding access. Expanding access in an equitable fashion has the potential to remedy some of the societal inequalities in healthcare and therefore health outcomes.

Network Analysis

The many components of the U.S. Healthcare System network will all need to act in some way to shift the healthcare system towards preventative medicine and implement the proposed program. The U.S. government will need to provide funding to the education system and to the food system and create policies to ensure that change can occur and does occur. It will also need to work with health insurance companies to ensure access to care. The changes are informed by other countries' healthcare systems and enacted in the U.S. education system. Doctors, mental health professionals, and teachers are all actors in the network, and will need to support the program. Students and patients, who are in most cases the same group, will both benefit from it and interact with the other actors in the network. These relationships are shown in Figure 1 below, which was generated for this analysis.

Figure 1

Actor-Network Theory Diagram of the Network Surrounding the United States Healthcare System (Graham, 2021).



Note. The connections between actors are shown using arrows, with the blue line signifying that patients and students tend to be the same individuals.

Conclusion

A school program that both educates students on mental health and nutrition, while also improving their access to both mental and nutritional healthcare would be an ideal initiative to improve the United States Healthcare system. It would do so by emphasizing nutrition and mental health as forms of preventative healthcare, such that if risk factors for preventable, chronic diseases are mitigated, then the prevalence of these conditions will decrease significantly. This would in turn decrease the growing economic burden on the United States Healthcare system, and improve the overall health of Americans. While this would require many

actors to take action, as is illustrated in the actor-network theory diagram in Figure 1, and it would not fix all of the problems with the United States Healthcare System, it would be a great first step to improving the system by shifting the focus towards prevention, and making healthcare more equitable and accessible.

References

Ackermann, R. T., Cheadle, A., Sandhu, N., Madsen, L., Wagner, E. H., & LoGerfo, J. P. (2003). Community exercise program use and changes in healthcare costs for older adults. *American Journal of Preventive Medicine*, *25*(3), 232–237. https://doi.org/10.1016/S0749-3797(03)00196-X

Adams, J., & Adams, M. (1996). The Association Among Negative Life Events, Perceived Problem Solving Alternatives, Depression, and Suicidal Ideation in Adolescent Psychiatric Patients. *Journal of Child Psychology and Psychiatry*, *37*(6), 715–720. https://doi.org/10.1111/j.1469-7610.1996.tb01463.x

Adan, R. A. H., van der Beek, E. M., Buitelaar, J. K., Cryan, J. F., Hebebrand, J., Higgs, S., Schellekens, H., & Dickson, S. L. (2019). Nutritional psychiatry: Towards improving mental health by what you eat. *European Neuropsychopharmacology*, *29*(12), 1321–1332. https://doi.org/10.1016/j.euroneuro.2019.10.011

American Diabetes Association. (2018). Economic Costs of Diabetes in the U.S. in 2017. *Diabetes Care*. https://doi.org/10.2337/dci18-0007

Benjamin, R. M. (2011). *National Prevention Strategy: America's Plan for Better Health and Wellness*. DIANE Publishing Company.

Bremner, J. D., Moazzami, K., Wittbrodt, M. T., Nye, J. A., Lima, B. B., Gillespie, C. F., Rapaport, M. H., Pearce, B. D., Shah, A. J., & Vaccarino, V. (2020). Diet, Stress and Mental Health. *Nutrients*, *12*(8), 2428. https://doi.org/10.3390/nu12082428

Brown, A. G. M., Esposito, L. E., Fisher, R. A., Nicastro, H. L., Tabor, D. C., & Walker, J. R. (2019). Food insecurity and obesity: Research gaps, opportunities, and challenges. *Translational Behavioral Medicine*, *9*(5), 980–987. https://doi.org/10.1093/tbm/ibz117

Centers for Disease Control and Prevention. (2014). *Healthier Food Retail: An Action Guide for Public Health Practitioners* (p. 160). U.S. Department of Health and Human Services. https://www.cdc.gov/nccdphp/dnpao/state-local-programs/pdf/Healthier-Food-Retail-guide-full.pdf

Centers for Disease Control and Prevention. (2015). *Results from the School Health Policies and Practices Study 2014* (p. 180) [Government Report]. U.S. Department of Health and Human Services. https://www.cdc.gov/healthyyouth/data/shpps/pdf/SHPPS-508-final_101315.pdf

Coleman-Jensen, A. (2018). *Household Food Security in the United States in 2018*. 47.

Connell, D. B., Turner, R. R., & Mason, E. F. (1985). Summary of Findings of the School Health Education Evaluation: Health Promotion Effectiveness, Implementation, and Costs. *Journal of School Health*, *55*(8), 316–321. https://doi.org/10.1111/j.1746-1561.1985.tb05656.x

Conner, T. S., Brookie, K. L., Carr, A. C., Mainvil, L. A., & Vissers, M. C. M. (2017). Let them eat fruit! The effect of fruit and vegetable consumption on psychological well-being in young adults: A randomized controlled trial. *PLOS ONE*, *12*(2), e0171206. https://doi.org/10.1371/journal.pone.0171206

Cressman, D. (2009). *A Brief Overview of Actor-Network Theory: Punctualization, Heterogeneous Engineering & Translation*. https://summit.sfu.ca/item/13593

Davis, J. N., Ventura, E. E., Cook, L. T., Gyllenhammer, L. E., & Gatto, N. M. (2011). LA Sprouts: A Gardening, Nutrition, and Cooking Intervention for Latino Youth Improves Diet and Reduces Obesity. *Journal of the American Dietetic Association*, *111*(8), 1224–1230. https://doi.org/10.1016/j.jada.2011.05.009

Di Daniele, N., Noce, A., Vidiri, M. F., Moriconi, E., Marrone, G., Annicchiarico-Petruzzelli, M., D'Urso, G., Tesauro, M., Rovella, V., & De Lorenzo, A. (2016). Impact of Mediterranean diet on metabolic syndrome, cancer and longevity. *Oncotarget*, *8*(5), 8947–8979. https://doi.org/10.18632/oncotarget.13553

Dinan, T. G., Stanton, C., Long-Smith, C., Kennedy, P., Cryan, J. F., Cowan, C. S. M., Cenit, M. C., van der Kamp, J.-W., & Sanz, Y. (2019). Feeding melancholic microbes: MyNewGut recommendations on diet and mood. *Clinical Nutrition*, *38*(5), 1995–2001. https://doi.org/10.1016/j.clnu.2018.11.010

Division of Population Health, & National Center for Chronic Disease Prevention and Health Promotion. (2021, February 16). *Nutrition Education in US Schools*. https://www.cdc.gov/healthyschools/nutrition/school_nutrition_education.htm

Dray, J., Bowman, J., Campbell, E., Freund, M., Wolfenden, L., Hodder, R. K., McElwaine, K., Tremain, D., Bartlem, K., Bailey, J., Small, T., Palazzi, K., Oldmeadow, C., & Wiggers, J. (2017). Systematic Review of Universal Resilience-Focused Interventions Targeting Child and Adolescent Mental Health in the School Setting. *Journal of the American Academy of Child & Adolescent Psychiatry*, *56*(10), 813–824. https://doi.org/10.1016/j.jaac.2017.07.780

Frydenberg, E., Care, E., Chan, E., & Freeman, E. (2009). Interrelationships between Coping, School Connectedness and Wellbeing Erica Frydenberg. *Australian Journal of Education*, *53*(3), 261–276. https://doi.org/10.1177/000494410905300305

Gonzalez, A. A. (2019, January 18). What Happens When Meditation Replaces School Detention. *Our Children*. https://ptaourchildren.org/meditation-not-detention/

Graham, C. (2021). *Actor-Network Theory Diagram of the Network Surrounding the United*

States Healthcare System.

Gravlee, C. C. (2009). How race becomes biology: Embodiment of social inequality. *American Journal of Physical Anthropology*, *139*(1), 47–57. https://doi.org/10.1002/ajpa.20983

Greenberg, H., & Pi-Sunyer, F. X. (2019). Preventing preventable chronic disease: An essential goal. *Progress in Cardiovascular Diseases*, *62*(4), 303–305. https://doi.org/10.1016/j.pcad.2019.08.002

Hales, C. M. (2017). *Prevalence of Obesity Among Adults and Youth: United States, 2015–2016*. *288*, 8.

Health, N. C. C. for M. (2005). Depression in children and young people: Identification and management in primary, community and secondary care. In *Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]*. Centre for Reviews and Dissemination (UK). https://www.ncbi.nlm.nih.gov/books/NBK71304/

Hills, R. D., Pontefract, B. A., Mishcon, H. R., Black, C. A., Sutton, S. C., & Theberge, C. R. (2019). Gut Microbiome: Profound Implications for Diet and Disease. *Nutrients*, *11*(7). https://doi.org/10.3390/nu11071613

Hodgkinson, S., Godoy, L., Beers, L. S., & Lewin, A. (2017). Improving Mental Health Access for Low-Income Children and Families in the Primary Care Setting. *Pediatrics*, *139*(1). https://doi.org/10.1542/peds.2015-1175

Hu, F. B., Manson, J. E., Stampfer, M. J., Colditz, G., Liu, S., Solomon, C. G., & Willett, W. C. (2001). Diet, Lifestyle, and the Risk of Type 2 Diabetes Mellitus in Women. *New England Journal of Medicine*, *345*(11), 790–797. https://doi.org/10.1056/NEJMoa010492

Jankauskiene, R., & Baceviciene, M. (2019). Body Image Concerns and Body Weight Overestimation Do Not Promote Healthy Behaviour: Evidence from Adolescents in

Lithuania. *International Journal of Environmental Research and Public Health*, *16*(5), 864. https://doi.org/10.3390/ijerph16050864

Kato, K. (2018). How does *Toxoplasma gondii* invade host cells? *Journal of Veterinary Medical Science*, *80*(11), 1702–1706. https://doi.org/10.1292/jvms.18-0344

Kondo, N. (2014). What Has Made Japan Healthy? *Japan Medical Association Journal : JMAJ*, *57*(1), 24–27.

Littlefield, L., Cavanagh, S., Knapp, R., & O'Grady, L. (2017). KidsMatter: Building the Capacity of Australian Primary Schools and Early Childhood Services to Foster Children's Social and Emotional Skills and Promote Children's Mental Health. In E. Frydenberg, A. J. Martin, & R. J. Collie (Eds.), *Social and Emotional Learning in Australia and the Asia-Pacific: Perspectives, Programs and Approaches* (pp. 293–311). Springer. https://doi.org/10.1007/978-981-10-3394-0_16

Lock, M., & Kaufert, P. (2001). Menopause, local biologies, and cultures of aging. *American Journal of Human Biology*, *13*(4), 494–504. https://doi.org/10.1002/ajhb.1081

Malan-Muller, S., Valles-Colomer, M., Raes, J., Lowry, C. A., Seedat, S., & Hemmings, S. M. J. (2018). The Gut Microbiome and Mental Health: Implications for Anxiety- and Trauma-Related Disorders. *Omics: A Journal of Integrative Biology*, *22*(2), 90–107. https://doi.org/10.1089/omi.2017.0077

Marx, W., Moseley, G., Berk, M., & Jacka, F. (2017). Nutritional psychiatry: The present state of the evidence. *Proceedings of the Nutrition Society*, *76*(4), 427–436. https://doi.org/10.1017/S0029665117002026

Mehta, N., Clement, S., Marcus, E., Stona, A.-C., Bezborodovs, N., Evans-Lacko, S., Palacios, J., Docherty, M., Barley, E., Rose, D., Koschorke, M., Shidhaye, R., Henderson, C., &

Thornicroft, G. (2015). Evidence for effective interventions to reduce mental health-related stigma and discrimination in the medium and long term: Systematic review. *The British Journal of Psychiatry*, *207*(5), 377–384. https://doi.org/10.1192/bjp.bp.114.151944

Milin, R., Kutcher, S., Lewis, S. P., Walker, S., Wei, Y., Ferrill, N., & Armstrong, M. A. (2016). Impact of a Mental Health Curriculum on Knowledge and Stigma Among High School Students: A Randomized Controlled Trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, *55*(5), 383-391.e1. https://doi.org/10.1016/j.jaac.2016.02.018

Miyoshi, M., Tsuboyama-Kasaoka, N., & Nishi, N. (2012). School-based "shokuiku" program in Japan: Application to nutrition education in Asian countries. *Asia Pacific Journal of Clinical Nutrition*. https://search.informit.org/doi/abs/10.3316/ielapa.005020511473466

Moon, J., Williford, A., & Mendenhall, A. (2017). Educators' perceptions of youth mental health: Implications for training and the promotion of mental health services in schools. *Children and Youth Services Review*, *73*, 384–391. https://doi.org/10.1016/j.childyouth.2017.01.006

Moreno-Agostino, D., Caballero, F. F., Martín-María, N., Tyrovolas, S., López-García, P., Rodríguez-Artalejo, F., Haro, J. M., Ayuso-Mateos, J. L., & Miret, M. (2019). Mediterranean diet and wellbeing: Evidence from a nationwide survey. *Psychology & Health*, *34*(3), 321–335. https://doi.org/10.1080/08870446.2018.1525492

Morris, J. L., & Zidenberg-cherr, S. (2002). Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *Journal of the American Dietetic Association*, *102*(1), 91–93. https://doi.org/10.1016/S0002-8223(02)90027-1

Murimi, M. W., Kanyi, M., Mupfudze, T., Amin, Md. R., Mbogori, T., & Aldubayan, K. (2017). Factors Influencing Efficacy of Nutrition Education Interventions: A Systematic Review. *Journal of Nutrition Education and Behavior*, *49*(2), 142-165.e1. https://doi.org/10.1016/j.jneb.2016.09.003

National Academies of Sciences Engineering, and Medicine, Health and Medicine Division, Board on Population Health and Public Health Practice, Committee on Community-Based Solutions to Promote Health Equity in the United State, Baciu, A., Negussie, Y., Geller, A., & Weinstein, J. N. (2017). The State of Health Disparities in the United States. In *Communities in Action: Pathways to Health Equity*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK425844/

National Center for Environmental Health. (2019). *Picture of America: Prevention*. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. https://www.cdc.gov/pictureofamerica/pdfs/picture_of_america_prevention.pdf

Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The relationship between physical and mental health: A mediation analysis. *Social Science & Medicine*, *195*, 42–49. https://doi.org/10.1016/j.socscimed.2017.11.008

Patel, V., Flisher, A. J., Hetrick, S., & McGorry, P. (2007). Mental health of young people: A global public-health challenge. *The Lancet*, *369*(9569), 1302–1313. https://doi.org/10.1016/S0140-6736(07)60368-7

Radder, H. (1992). Normative Reflexions on Constructivist Approaches to Science and Technology. *Social Studies of Science*, *22*(1), 141–173.

Rodger, K., Moore, S. A., & Newsome, D. (2009). WILDLIFE TOURISM, SCIENCE AND ACTOR NETWORK THEORY. *Annals of Tourism Research*, *36*(4), 645–666.

https://doi.org/10.1016/j.annals.2009.06.001

Sapthiang, S., Van Gordon, W., & Shonin, E. (2019). Mindfulness in Schools: A Health Promotion Approach to Improving Adolescent Mental Health. *International Journal of Mental Health and Addiction*, *17*(1), 112–119. https://doi.org/10.1007/s11469-018-0001-y

Sarris, J. (2019). Nutritional Psychiatry: From Concept to the Clinic. *Drugs*, *79*(9), 929–934.

Schmitt, S. A., Bryant, L. M., Korucu, I., Kirkham, L., Katare, B., & Benjamin, T. (2019). The effects of a nutrition education curriculum on improving young children's fruit and vegetable preferences and nutrition and health knowledge. *Public Health Nutrition*, *22*(1), 28–34. https://doi.org/10.1017/S1368980018002586

Schwimmer, J. B. (2005). Preventing Childhood Obesity: Health in the Balance. *Environmental Health Perspectives*, *113*(10), A706.

Stampfer, M. J., Hu, F. B., Manson, J. E., Rimm, E. B., & Willett, W. C. (2000). Primary Prevention of Coronary Heart Disease in Women through Diet and Lifestyle. *New England Journal of Medicine*, *343*(1), 16–22. https://doi.org/10.1056/NEJM200007063430103

Velardo, S. (2015). The Nuances of Health Literacy, Nutrition Literacy, and Food Literacy. *Journal of Nutrition Education and Behavior*, *47*(4), 385-389.e1. https://doi.org/10.1016/j.jneb.2015.04.328

Vidourek, R. A., & Burbage, M. (2019). Positive mental health and mental health stigma: A qualitative study assessing student attitudes. *Mental Health & Prevention*, *13*, 1–6. https://doi.org/10.1016/j.mhp.2018.11.006

Virani, S. S., Alonso, A., Benjamin, E. J., Bittencourt, M. S., Callaway, C. W., Carson April P.,

Chamberlain Alanna M., Chang Alexander R., Cheng Susan, Delling Francesca N., Djousse Luc, Elkind Mitchell S.V., Ferguson Jane F., Fornage Myriam, Khan Sadiya S., Kissela Brett M., Knutson Kristen L., Kwan Tak W., Lackland Daniel T., … null null. (2020). Heart Disease and Stroke Statistics—2020 Update: A Report From the American Heart Association. *Circulation*, *141*(9), e139–e596. https://doi.org/10.1161/CIR.0000000000000757

Zoogman, S., Goldberg, S. B., Hoyt, W. T., & Miller, L. (2015). Mindfulness Interventions with Youth: A Meta-Analysis. *Mindfulness*, *6*(2), 290–302. https://doi.org/10.1007/s12671-013-0260-4