

Burden of COVID-19 Pandemic on Mental Health and Related Behavioral Stressors of Students in Pennsylvania Schools

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Abstract:

COVID-19 has generated substantial stress on students' mental health. This study collected primary and secondary data to compute a mental health stress index of youth mental stress levels and to examine the impact of the pandemic on youth behaviors. Using PAYS data from pre-pandemic (2017, 2019) and pandemic (2021) time periods, the study finds an increase in the percent of students experiencing mental stress in grades 6, 8, 10, and 12 in 2021, compared to the corresponding percentages from 2017 and 2019. The study finds that student mental health stress in rural counties is related to key socioeconomic and demographic indicators, such as, childhood poverty rates, unemployment, levels of education, lack of access to internet, the number of single-parent households, the number of households receiving SNAP and Supplemental Security Income, low infant birth weight, and lack of prenatal care. Altogether, students whose families were already more vulnerable socioeconomically, also experienced more notable negative mental health consequences during the COVID-19 pandemic. Further, there is evidence to suggest that academic performance has been affected negatively by students' increased levels of mental health stress. While most empirical relationships are similar in urban counties, policy makers must consider the differential prevalence of factors, such as, limited access to internet and health care in rural areas, when designing solutions to address student needs.

Keywords: PAYS Data, Mental Health Index, Behavioral Stressors, COVID-19, Students

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Executive Summary

Purpose

This research examined the impact of the COVID-19 pandemic on youth mental health and related behavioral stressors. It developed a mental health stress index to compare student stress levels in 2021 with those in 2017 and 2019 and examined the relationship between the prevalence of stress and other factors for rural and urban counties.

Monitoring this index is important because emotional stress can lead to a wide range of unhealthy behaviors and outcomes, and potentially affect educational outcomes as well.

Methods

The study used Pennsylvania Youth Survey (PAYS) data for the survey years 2017, 2019, and 2021 for students in grades 6, 8, 10, and 12. The survey has been conducted since 1989 by the Pennsylvania Commission on Crime and Delinquency; it is implemented at the school level and students respond to a large array of questions that focus on emotional health and well-being, substance use, and violence. The 2021 survey was completed in 467 public school districts, and in some charter schools and other types of schools. In 2021, more than 246,200 students completed the PAYS survey.

This study used the responses to compute a student's mental health stress index. The mental health stress index combines several responses from the PAYS survey related to a student's emotional and psychological well-being to generate a single indicator of a student's mental health status. This indicator includes aspects of the surrounding environment.

The index serves as an indicator to classify those students who experience high levels of emotional stress, those who are vulnerable with moderate stress or in the at-risk group, and those with low levels of stress. A higher mental health stress index score indicates a larger psychological strain experienced by the student.

The study computed the mental health index for every student in the sample. Responses were aggregated at the county level for the years 2017, 2019, and 2021, for the whole sample, and for rural and urban counties. The study then classified each county according to the percentages of students who fell in the high emotional stress and at-risk groups.

The research also collected data on key indicators for various socioeconomic and academic characteristics from the Census Bureau and the Pennsylvania Department of Education (PDE). The study used statistical tests to understand the relationship between mental stress levels and socioeconomic and academic outcomes. Additional analyses examined the rural and urban differences.

Results

The major findings of the study are as follows:

1. The percentage of students with notable emotional and psychological stress levels in 2021 is higher than stress levels recorded in 2017 and 2019.

- Approximately half of Pennsylvania schoolchildren surveyed were either highly emotionally stressed or in the at-risk group. For the full sample, the percentage of students with high mental health stress levels has increased from 4% in 2017 to 8% in 2021. It is also important to note that the percentage of students whose responses place them at an at-risk mental health stress level has increased from 36% in 2017 to 42% in 2021.
2. Rural counties had a significantly larger percentage of students with high levels of mental stress.
 3. The percentage of students with high mental health stress levels in rural counties has increased from 5% in 2017, and 6% in 2019, to 8 percent in 2021, and this is higher than percentages observed in urban counties.
 4. The percentage of students with at-risk mental health stress levels has also increased in rural areas from 36% in 2017 to 42% in 2021. The results are strikingly similar for urban counties. Therefore, schools across *all* counties face similar challenges from increased percentages of students with at-risk mental health stress levels.
 5. Of particular concern is the sharp increase in the number of rural counties, which have a large percentage of students (above 9%) with high stress levels (2 in 2019 to 17 in 2021). There was also a 55% increase in the number of rural counties from 2017 to 2021, with a large proportion (over 35%) of students in at-risk stress levels.
 6. For both rural and urban students, and across all grades, there were increases in the percentages and the intensity of stress levels in 2021, when compared with their pre-COVID levels. The increase in mental stress levels is attributed to perceptions of risk factors, such as bullying and internet safety, health concerns and suicide risk, and related systemic factors. Also, the increase in emotional stress levels is related to lower levels of participation and involvement, as measured by responses to questions measuring commitment to school, social and emotional health, and most importantly, students' lower involvement in pro-social activities.
 7. For both rural and urban counties, moderate or at-risk levels of mental health stress at the county level were statistically related to higher percentages of childhood poverty, unemployment, levels of education, households receiving SNAP and Supplemental Security Income, low infant birth weight, and lack of prenatal care.
 8. Additionally, single-parent households with children and households with a lack of internet access are associated with high levels of stress in rural counties.
 9. Importantly, higher stress levels are associated with low academic performance in both rural and urban districts.
 10. The results suggest a multifaceted approach to addressing youth mental and emotional stress because they are complex issues. Approaches should include

involvement of key stakeholders, such as parents, school and mental health professionals, and community organizations, to facilitate social improvement and youth enrichment programs.

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Introduction

The Centers for Disease Control and Prevention (CDC) and related research (Leeb et al., 2020a, b) note that the pandemic has taken a toll on the psychological dispositions of youth. Studies indicate that the psychological and academic performance trajectories will most likely unfold over time, with severe negative consequences on children's mental development. Consequently, psychologists, pediatricians, health administrators, and educators have started to examine the full impact of the pandemic on children's mental health.¹

From an economic standpoint, there are private and social costs associated with mental health. Private costs are those costs borne by the individual, while social costs reflect all external costs borne by the rest of society. A crucial private cost of a child's lower educational achievement is the child's lower human capital accumulation, resulting in a lower lifetime wage profile. An individual's mental health care costs from the pandemic also fall in this category. Social costs from mental strain cover negative externalities from society's lower productivity, income inequality, and higher health care costs.

The causes of negative mental health outcomes attributed to the pandemic are straightforward: isolation, contact restriction, economic shutdown, lack of peer contact, social distancing. Reductions in physical activity and sports, increases in sedentary behavior, disrupted sleep schedules and sleep quality in children, and other school-related or community-based organized physical activity are all related issues, which have an impact on mental stress and educational outcomes.² Researchers have established that the above factors expose children to strained psycho-social environments leading to problems with physical health, due to increased screen time and disorganized sleeping and eating patterns or habits. Extant research makes it clear that socio-affective complications and insufficient physical activities among children, particularly among the marginalized and those from disadvantaged socioeconomic circumstances cannot be adequately overemphasized.

As a consequence, mental stress leads to increased levels of depression, anger, loneliness, distress, fear, low self-esteem, loss of confidence, sleep disorders, irritability, alienation, pessimism, and hopelessness.

Related factors that belie the above-mentioned psychological ill-effects on children are the pre-existing mental conditions of parents and caretakers that produce negative secondary effects. For instance, Elder and Greene (2021) evidence demonstrate a large negative impact of COVID-19 on parents' mental health in the US, and further, Zamarro le

¹See Benner and Mistry (2020), Lopez-Bueno et al. (2021), Miranda et al. (2020) and Ghosh et al. (2020) for the impact of social isolation on educational attainments.

²Zhang and Lee (2020) apply the hierarchical motivation model of education to the situation in U.S. schools and link the importance of youth sports to the overall sense of well-being.

and Prados (2021) demonstrate that the psychological impact is heavier on mothers with young and school-age children³.

Data from U.S. households indicate the pervasiveness of increased mental health concerns among children exposed to caregivers who themselves experience significant negative mental health outcomes. In most cases, parental burnout and stress often exhibit themselves in various forms of child maltreatment.⁴ For instance, The U.S. National Syndromic Surveillance Program (NSSP) data shows that the rate of emergency room visits related to child abuse and neglect has increased since the onset of the pandemic, primarily due to loss of income, increased stress related to parental child care, educational responsibilities, substance abuse, and pre-existing mental health conditions among adults.

Pressures of home schooling and disruption of the educational process are projected to have major negative effects in the short and long terms with respect to educational attainment and skills acquisition. Lack of access to robust technology and infrastructure is a major problem for different family groups, including rural residents and those with low socioeconomic status.

The importance of the physical environment and policy on mental health, particularly during the pandemic, is evidenced through two related issues: food insecurity and the digital divide.⁴

Akseer et al. (2020), Dunn et al. (2020), and Kelly et al. (2020) also stress the importance of maternal and child health and how a concerted effort was needed to address all issues at the same time during the pandemic. Additionally, Immediate policy action by the U.S. was needed for the following: nutritional demands for children in low-income families, and more attention to the SNAP Program, School Breakfast Program, and Child and Adult Care Food Program.⁵

Most importantly, almost all studies cite the need for more data that spans demographic and socioeconomic circumstances, along with mental health status. The current study takes all of the above-mentioned concerns into consideration in creating a mental health stress index, and investigates the status of mental health in K-12 schools in PA.

The Commonwealth of PA has established programs to help rural youth cope with mental health concerns, providing expedited resources for enhanced response co-

³Extant research indicates similar findings from other countries such as China, Japan, and UK. The psychological toll of COVID-19 has been large on female college students in China (Si et al., 2021), less-educated mothers in Japan (Yamamura and Tsutsui, 2021), and on working parents within financially insecure households in the UK (Cheng et al., 2021).

⁴For evidence of physical ailments during the COVID-19 pandemic, made worse due to undernutrition and undeveloped health systems, see Coker et al. (2020), Cohen and Bosk (2020), Liu et al. (2020), McKinney (2020).

⁵See Babu, Gajanan and Hallam (2017) and Babu and Gajanan (2021) for the importance of SNAP and NSLP in alleviating food insecurity and malnourishment, among low-income groups, particularly during the COVID-19 pandemic.

ordination.⁶ The statement from Senators Scott Martin (R-13, Lancaster County) and Michele Brooks (R-50, Mercer, Crawford, and Lawrences counties) succinctly underscores the challenges in this context:

“Big concerns include rising truancy rates, lack of consistent safety guidelines from the state, staff shortages, technology challenges and, most prominently, the toll the pandemic has had on mental health,” (Callahan, *Courier Times*, March 3, 2021).

Extant research cited above has identified the following challenges schools face due to the pandemic:

- Substantial difficulty in establishing effective student-teacher contact, thereby impacting short and long-run educational outcomes, skill development, and human capital formation.
- Significant decreases in motivation, engagement, and performance.
- Absences of professionals (teachers, general health practitioners, social and youth workers), preventing early detection and intervention.
- Significant obstacles related to food insufficiency, housing instability, physical and mental health issues, and individualized student mentoring, counseling, and tutoring.

Goals and Objectives

The key expected outcome of this project is to gain an understanding of the severity of students’ mental health conditions, using behavioral and attitudinal measures, before and during the COVID-19 pandemic. The emphasis on mental health and behavioral outcomes serves as the main motivation for setting up the goals, objectives, and the research methodology for the current project. The research project goals, data, and analytical methodology link information from PAYS data to socioeconomic and demographic factors across counties in Pennsylvania.

The current research project is the first of its kind to examine the issue of mental health conditions evidenced through behavioral outcomes and linking aggregate outcomes to socioeconomic and demographic information. The study compares the outcomes from the pre-pandemic years (2017, 2019) with those from the pandemic time-period (2021) using PAYS survey data.

The study uses the information and results to provide positive feedback on possible strategies and action-plans. This study is also an extension of Murphy (2018), who used PAYS 2017 data, identified the differences in rural and urban drug use and violence, and indicated school-based interventions as possible prevention strategies.

More recently, the 2021 Pennsylvania Youth Survey: *Empowering Communities to Develop Strategic Prevention Programming*, adds further questions allowing for the measurement of specific impacts of the pandemic and experiences with remote learning.

⁶See Appendix 6 for a list of all resources in PA that address mental health issues and related concerns.

The purpose of the current study is to use the indicators included in the PAYS data sets from the years 2017, 2019, and 2021.

The specific objectives of the study are:

- Collect key statistical data from Pennsylvania Youth Survey (PAYS) that track 6th, 8th, 10th, and 12th grade students' knowledge, attitudes, and behaviors. The information includes rural and urban students, from three survey rounds: 2017 and 2019 (pre-pandemic), and 2021 (during the pandemic).
- Present socioeconomic profiles at the aggregate level of those rural and urban counties that have the greatest and the lowest incidences of mental stress and prevalence of antisocial behavior.
- Compare the trends in the prevalence of antisocial behavior and mental health status between pre-pandemic and during-pandemic levels and examine the relationship between those trends and socioeconomic conditions at the county level.
- Characterize and link the trends in mental health status and antisocial behavior to factors associated with socioeconomic conditions, educational indicators and educational outcomes, and derive observed differences between rural and urban counties.

Methodology

The study used Pennsylvania Youth Survey (PAYS) data for the survey years 2017, 2019, and 2021, for grades 6, 8, 10, and 12. Individual students respond to a large array of questions that focus on emotional health and well-being; surveys are administered at the school level.

The data were used to examine trends for the whole sample, for different grades, for rural and urban school districts, and rural and urban counties.

Students were identified as part of a rural or urban county using the Center for Rural Pennsylvania's definition of rural and urban counties as follows: a county is rural when the population density is below the statewide average of 291 persons per square mile; a county is urban when the population density is at or above 291 persons per square mile.

The PAYS data provided information on a student's perceptions and experiences on a number of questions. The study used the responses to compute a student's mental health stress index. The mental health stress index combines several responses from the survey and generates a single indicator that represents a student's mental stress level. The study constructed a multidimensional mental health stress index, based on the Alkire-Foster (AF) method for building Multidimensional Poverty Index (MDPI), which has become very influential in poverty analysis and policy. Following the methodology of Professors Sabina Alkire and James Foster (2013)⁷ the study assumed that mental health status and related

⁷For details on the method, literature review and STATA implementation, see Babu and Gajanan (2021).

psychological anxiety issues cannot be confined narrowly to a unidimensional metric, for example, just based on “feeling depressed”. Rather, the construction of a mental health stress index must include a whole range of deprivations as mentioned above.

The mental health stress index helps identify those students who experience high mental stress levels, and those who are vulnerable or in the at-risk group. A higher index score indicates a higher level of emotional stress experienced by the student.

The PAYS survey questionnaire elicits responses from students for a wide variety of behavioral and emotional stressors, such as access to health, food, technology, physical activity, appropriate conditions for sleep and counseling, along with academic preparedness, parental guidance, support from friends and neighbors, and involvement in social and community activities. A student who is deprived in several of these categories is categorized as experiencing high mental stress.

The study used all the responses from every student from the PAYS data to develop an index of mental health stress index. Based on the index, each student was classified into one of the following groups:

- Type 1: Low: students with relatively low mental stress levels
- Type 2: At-Risk: students who are vulnerable and face moderate stress levels
- Type 3: High: students with relatively high mental stress levels

An attractive feature of the AF method is that it allows for decomposition of population among different subgroups, and across different dimensions: such as rural and urban. Consequently, applying the AF methodology is appropriate within the given framework and data structure. The study applied the method and constructed the percentage of students who are mentally stressed within each category of PAYS survey questions.

The research also collected data on key indicators for various socioeconomic and educational characteristics at the county level. These included household size and type, race and ethnicity, age, educational attainment levels, poverty rates, housing values, income, PSSA scores in Math and Reading for grades 6 and 8, the percent of students eligible for the free and reduced lunch programs, total enrollment in schools, counselling staff, total staff ratio, the number of misconduct incidents, and other related variables.

The socioeconomic and educational indicators were linked to the mental stress levels at the county level. The study used various levels of statistical analyses to test the association between aggregate mental stress levels and the socio-economic academic performance and educational indicators. The research examines the relationships for the whole sample and the rural and urban subsamples.

In summary, the study used the PAYS data and computed mental health stress index scores to obtain the following information:

- Derive trends in key variables that affect psychological and emotional health and use these variables to construct a mental health stress index for every student taking the survey for the years 2017, 2019, and 2021.
- Derive the distribution of at-risk and high stress status for rural and urban counties.

- Link the percentage of students with different mental health stress levels to socioeconomic characteristics, student achievement, and educational characteristics at the aggregate level.
- Use analysis of variance techniques to characterize the link between mental health stress levels and the exogenous variables for the full sample and for rural and urban counties.

Table 1 shows the total number of students who undertook the PA Youth Survey in 2017, 2019, and 2021. Table 2 shows the number of school districts covered in the study, located in rural and urban counties.

Overall, Table 1 shows that on average, about 32.3% of students are from rural areas, while about 67.6% of students are located in urban areas. Table 2 indicates that about 52% of the school districts are in rural counties, and 48% are in urban counties.

Table 1: Number of Student PAYS Respondents in Rural and Urban Counties, 2017, 2019, and 2021

	Counties		
Year	Rural	Urban	Total
2017	89,021	164,545	253,566
2019	92,144	188,800	280,944
2021	81,694	164,618	246,312

Table 2: Number of School Districts in Rural and Urban Counties, 2017, 2019, and 2021

	Counties		
Year	Rural	Urban	Total
2017	222	196	418
2019	236	234	470
2021	230	212	442

Pennsylvania Youth Survey (PAYS)

The Pennsylvania Commission on Crime and Delinquency (PCCD), the Pennsylvania Department of Drug and Alcohol Programs (DDAP), and the Pennsylvania Department of Education (PDE) undertake a detailed survey every other year, from 6th, 8th, 10th, and 12th grade students. The Pennsylvania Youth Survey (PAYS) gathers information about the knowledge, attitudes, and behaviors towards alcohol, tobacco, and other drug use.⁸

The survey also includes questions regarding students' perceptions about academic performance, antisocial behavior, and general well-being. For instance, the survey gathers

⁸For details on PAYS see [https://www.pccd.pa.gov/Juvenile-Justice/Pages/Pennsylvania-Youth-Survey-\(PAYS\).aspx](https://www.pccd.pa.gov/Juvenile-Justice/Pages/Pennsylvania-Youth-Survey-(PAYS).aspx) and <https://epis.psu.edu/pays>.

information and the extent of food insecurity, family stability and support, and the loss of close relatives and friends. Questions cover four broad domains (community, school, family, and peer/individual) to help policymakers and district officials identify which programs and initiatives to promote, for the best impact on student learning and experiences.

In this regard, PAYS serves as a useful tool towards implementing data-driven approaches towards prevention and mitigation of behavioral issues among PA youth. Survey questions cover a variety of students’ risk-related behaviors and attitudes.

For example, a survey question that measures the incidence of early access and use of alcohol is: *How many times (if any) have you had beer, wine, or hard liquor in your lifetime/during the last 30 days?*

The PAYS questionnaire has over 300 questions that comprehensively cover similar risk-related and emotional responses. PAYS also administers additional questions based on timely issues, interests, and developments. For instance, 21 new questions pertaining to the impact of COVID-19 pandemic were included in the 2021 survey.

To facilitate the discussion of the questionnaire and the responses, the study grouped sets of questions into specific categories. The advantage of organizing questions into these nine categories allows the study to organize the trends from the survey responses, which in turn aids in understanding the underlying behavioral stressors. Table 3 presents the nine different categories, which have been identified in the study, into which specific PAYS questions have been grouped.⁹

For example, the PAYS question: *How interesting are most of your courses to you?* is placed under the category, Commitment to School. Similarly, the PAYS question: *There are people in my neighborhood who are proud of me when I do something well,* is placed under the category, Social and Emotional Health.

Table 3: Categories of PAYS Responses

#	Categories Used for Grouping Responses
1	Commitment to School
2	Systemic Factors
3	Involvement in Pro-Social Activities
4	Social and Emotional Health
5	Bullying and Internet Safety
6	Mental Health Concerns and Suicide Risk
7	Risky Substance Use Related and Other Antisocial Behavior
8	Perception of Risk
9	Risk and Protective Factors
Source: PAYS data. The table shows the different categories under which PAYS questions and responses have been grouped.	

⁹ The entire list of questions along with the corresponding PAYS codes are in Appendix 2.

The study examined the trends in responses to each of the PAYS questions from the survey years 2017, 2019, and 2021, to identify the patterns and characterize the behavioral responses and emotional status in the data.

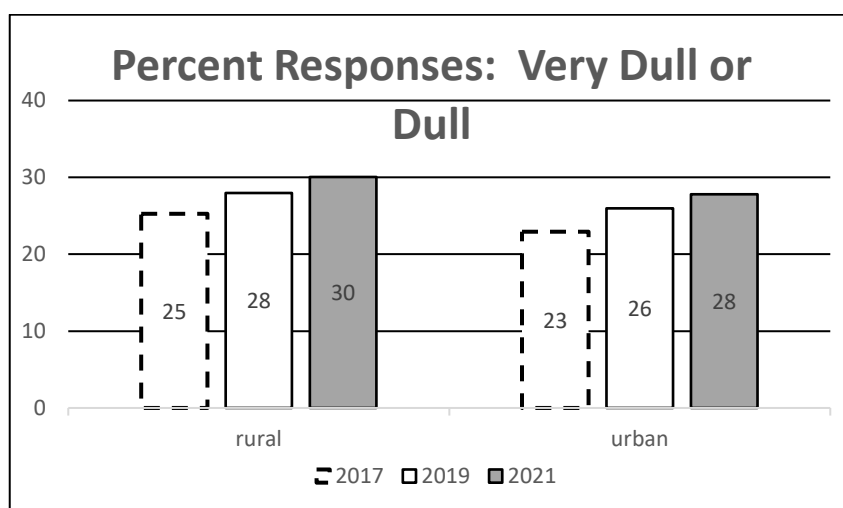
Figures 1-5 summarize responses to some of the questions used in the index to demonstrate some of the factors that contribute to the overall patterns. For example, consider the question under the category, Commitment to School: *How interesting are most of your courses to you?* Figure 1 below tracks the percentage of students who responded dull or very dull to this question, in rural and urban counties for the three years under consideration. Note that in both urban and rural counties, the percentage of students with the said response has increased by 5% in 2021, compared to 2017.

Likewise, consider a question that is grouped under the category, Social and Emotional Health: *There are people in my neighborhood who are proud of me when I do something well.* Figure 2 below indicates that in 2021 compared to 2017, the percentage of students who responded “no” to the question has increased by 5% in both rural and urban counties.

Similarly, Figure 3 tracks the responses for the question: *How often do your parents tell you they’re proud of you for something you’ve done?* under Systemic Factors. Likewise, responses to two questions under the category Involvement in Pro-Social Activities presented in Figures 4 and 5 include, *In the past 12 months, in which of the following activities did you participate?* and; *How often do you attend religious services or activities?*

The behavioral responses and trends from Figures 1-5 below reflect moderately increasing levels of mental stress and emotional strain among students between the years 2017 and 2021 across both rural and urban counties in PA.

Figure 1: Pennsylvania Student Interest and Commitment to School, Rural and Urban Counties



Note: The figure above table presents the percent of students who responded “Dull” or “Very Dull” to the PAYS question: *How interesting are most of your courses to you?*

Figure 2: Pennsylvania Student Social Support, Rural and Urban Counties

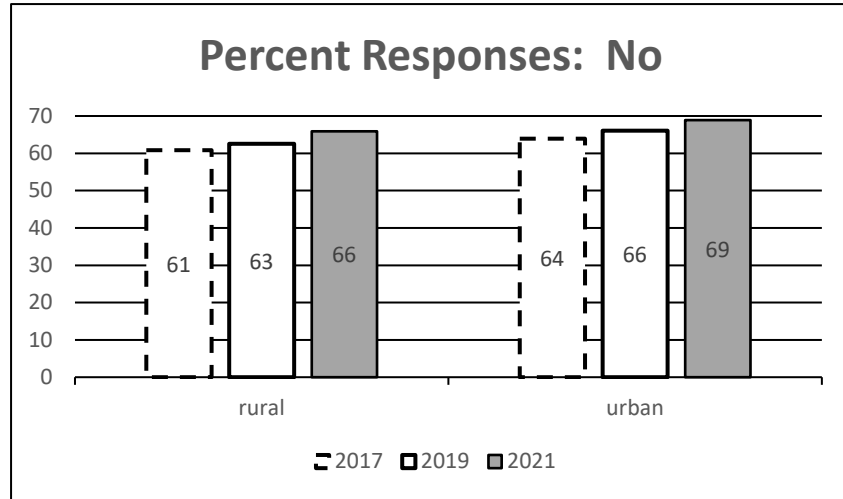


Figure 3: Pennsylvania Student Reports of Parental Pride, Rural and Urban Counties

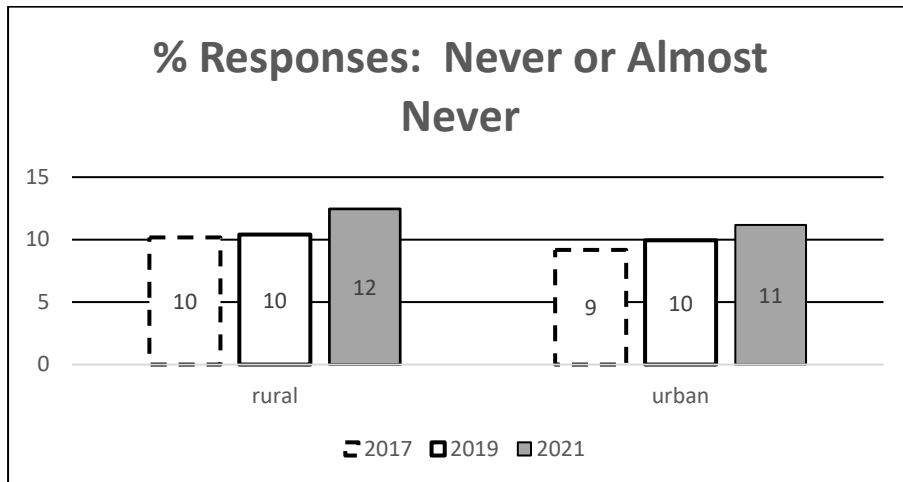


Figure 4: Pennsylvania Student Reports of Activities, Rural and Urban Counties

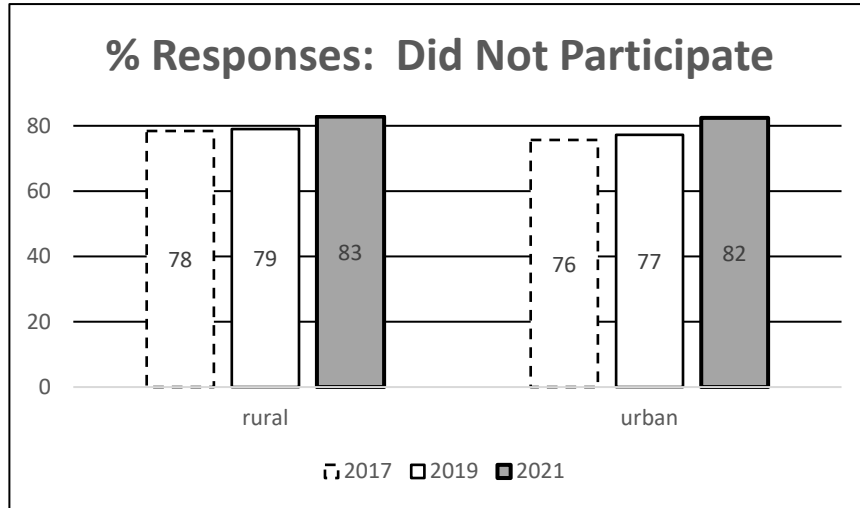
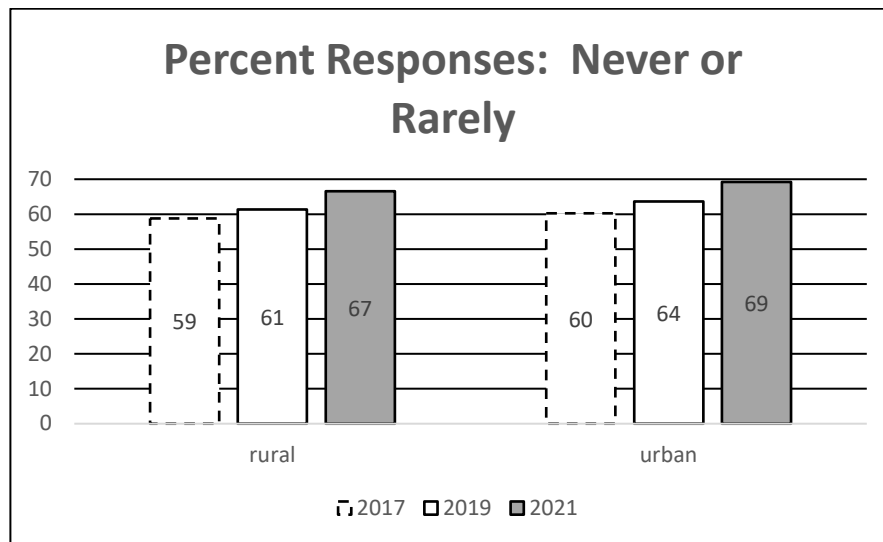


Figure 5: Pennsylvania Student Reports of Attending Religious Services or Activities, Rural and Urban Counties



Note that the trends in Figures 1-5 are for individual questions within a specific category. The study used groupings of questions to compute two summative indicators of mental stress. First, based on responses to individual questions, the study computed the percentage of mentally stressed students in each category. The percentage of mentally stressed students, or the incidence of mental stress for each category, was computed for the full sample covering all students, and separately for rural and urban subsamples at the county level for two grade groups (grades 6 and 8 and grades 10 and 12) for the pre- and post-pandemic time periods.

Second, the study used the mental stress levels of each category and derived a single composite aggregate mental health index for the full sample and for rural and urban subsamples at the county level. The single aggregate measure of mental stress is useful as it efficiently summarizes the extent of stress levels. Further, the study also derived the underlying distribution of mental stress, into high stress and at-risk stress levels.

The study used the distribution of mental stress to identify patterns and trends to characterize the incidence of emotional strain, during pre-COVID and post-COVID time periods, in rural and urban counties in PA. The study also linked the distribution of mental stress levels to socioeconomic and educational features using county level data.

Results

The study examined each of the questions from the PAYS data and placed each of the questions into one of nine categories, as outlined in Table 3. Using the Alkire and Foster methodology, the study computed the percentage of emotionally stressed individuals within each of the nine categories based on their responses to each item in the survey, for the years 2017, 2019, and 2021. (See Appendix 3 for more details on methodology.)

Based on responses to the questions, a composite mental health index was developed for each student in the sample. The study computed a single composite index of mental health and classified each student into one of the following groups:

- Type 1: Low: students with relatively low mental stress levels
- Type 2: At-Risk: students who are vulnerable and face moderate stress levels
- Type 3: High: students with relatively high mental stress levels

Table 4 shows the percentage of students with high and at-risk levels of mental stress for the full sample, and for the subsamples of schools from rural and urban counties. Overall, the trends are clear: on average, mental stress levels in 2021 have increased, compared to the levels in 2017 and 2019. For the full sample, the percentage of students with high stress levels in 2021 has increased by 3.3% since 2017, while the percentage of students with at-risk stress levels in 2021 has increased by 5.3%.

The percentage of students with high stress levels in rural counties has increased from 4.88 in 2017 to 8.33. Further, students in rural counties have a higher percentage rate of high stress levels compared to the students in urban counties.

The percentage of students with at-risk stress levels has also increased in rural counties from 35.85 in 2017 to 41.88 in 2021. The results are also strikingly similar for students from urban counties.

Overall, about 49.34% of PA schoolchildren are currently emotionally stressed either at high or at the at-risk levels, and the incidence of emotional and psychological stress levels has increased since 2017 and 2019.

Table 4: Students with High and At-Risk Mental Stress Levels, Statewide, Rural and Urban Counties

Year	High Stress Levels			At-Risk Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
2017	4.12%	4.88%	3.71%	35.85%	35.94%	35.81%
2019	5.01%	5.63%	4.71%	38.18%	37.76%	38.39%
2021	7.46%	8.33%	7.02%	41.88%	41.29%	42.17%

Table 5 presents the distribution of students with high and at-risk mental stress levels within rural and urban counties in the state, for 2017-21. The top panel presents the percentage of students with high stress levels, in rural and urban counties. Table 5 indicates that the mean percentages of students with high stress levels have increased by 3% during 2017-2021, in both the urban and rural counties. An important feature is the increase in the maximum percent of students affected with high stress levels in rural counties, from 14.29% in 2017 to 32.35% in 2021.

Table 5: Frequencies of Students with High and At-Risk Mental Stress Levels, Rural and Urban Counties

	High Stress Levels Rural Counties			High Stress Levels Urban Counties		
	2017	2019	2021	2017	2019	2021
Minimum	0.51%	0.98%	1.64%	0.86%	0.74%	0.82%
Maximum	14.29%	16.83%	32.35%	15.49%	33.33%	16.28%
Mean	5.03%	5.63%	8.45%	4.18%	5.29%	7.47%
	At-Risk Stress Levels Rural Counties			At-Risk Stress Levels Urban Counties		
	2017	2019	2021	2017	2019	2021
Minimum	9.09%	15.15%	7.14%	18.99%	14.04%	24.00%
Maximum	62.34%	67.31%	66.67%	70.00%	69.57%	73.33%
Mean	35.60%	37.80%	41.23%	37.91%	39.97%	43.39%

The distribution of high and at-risk stress levels in Tables 4 and 5 can be used to identify those counties that have a large incidence of students with high and at-risk stress levels. Counties with more than 9% of students with high stress levels are classified as counties which have a high incidence in high stress levels. Counties with more than 35% of students with at-risk stress levels are considered as counties with a high incidence of at-risk stress levels.

Table 6 indicates the number of rural and urban counties with high incidence of students with high and at-risk mental stress levels, from 2017 to 2021. The first three columns of Table 6 present the number of counties with a high incidence of high level of stress.

It is important to note that, compared to 2017 and 2019, the number of rural counties with a high incidence of high stress levels in 2021 has increased significantly. During this time period, however, the number of urban counties with a high incidence of high stress levels has remained consistently low.

The last two columns of Table 6 report the number of counties with high incidence of at-risk stress levels. Two key features are noteworthy. First, for all the three years, there are more rural counties than urban, with a large percentage of students with at-risk stress levels. Second, while the number of both urban and rural counties with high incidence of at-risk stress has increased every year, the increase in rural counties from 29 in 2017 to 45 in 2021 (or 55%) is substantially larger than 33% in urban counties during the same time period.

Table 6: Number of Counties with High Incidence of High and At-Risk Stress Levels, Rural and Urban Counties

Years	High Stress Levels		At-Risk Stress Levels	
	High Incidence		High Incidence	
	Counties		Counties	
	Rural	Urban	Rural	Urban
2017	0	0	29	14
2019	2	0	36	17
2021	17	1	44	19

Consequently, the overall trends from different distribution classifications show that issues surrounding youth mental and emotional status alongside a global pandemic are ongoing and are relatively significant in rural counties. To the extent that students with high stress are concentrated in particular areas, individual school districts and counties are facing higher demand for adequate resources to cope with the consequences.

Findings: Demographic Indicators

The average population during 2017-21 of a typical rural county is around 69,000, and around 520,000 for an urban county. The non-white population comprises roughly 9% of the rural county population, and nearly 20% of the population in urban counties (Table 7).

There are some similarities in the overall demographics of rural and urban counties. Both rural and urban counties have similar age cohorts, with approximately 20% of the population of school age (less than 18 years). The percentage of single-parent homes is similar across both urban and rural areas at 8%, as is the percentage of households without insurance (about 7%). The percentage of the population with a Bachelor level or higher degree is substantially higher in urban counties. Urban counties also have somewhat better access to internet; the average number of households with no internet access in rural areas is approximately 21%, compared to 15% in urban counties. The percentage of households

without access to health insurance is also approximately similar across both areas (around 7%).

Table 8 presents the results of correlation analysis between the percentage of students with at-risk or high mental stress, and the demographic indicators. Correlation measures were estimated for the rural and urban subgroups and for the entire data at the county level. For the rural counties, the percentage of families with single parents (no spouse, with children < 18), with an associate degree or less are both positively but weakly correlated to the percentage of students with at-risk stress levels.

For the urban counties the percentage of the population with a Bachelor's degree or higher is weak, but significant and negatively related to percentages of students with at-risk stress levels. Importantly, for the rural counties, the higher the number of households without internet access, the higher the stress levels. (Additional ANOVA analyses are available to the interested reader in Appendix 6.)

Overall, in rural counties the data indicate that lower education levels in the adult population, combined with lack of internet access are related to the observed stress levels of students, whether moderate or high. As the circumstances surrounding the COVID-19 pandemic led to higher expectations for remote learning and parental guidance, these demands placed a particular burden on households without adequate internet access and higher levels of education. In rural counties, at-risk stress levels were correlated with the frequency of households with some college but no degree. The data show that the added factor of single-parent households was also related to the proportion of students with at-risk stress levels; while relevant in rural areas, this particular pattern was more notable in *urban areas*.

Table 7: Demographic Characteristics of the Percentage of Students in High and At-Risk Stress Levels, Rural and Urban Counties

Demographic Characteristics	Stress Level/Incidence Rate							
	High Stress		At-Risk Stress		High Stress		At-Risk Stress	
	High Incidence		High Incidence		Medium Incidence		Medium Incidence	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Population								
Total Population	56,257	759,010	74,704	407,892	76,820	416,912	69,837	512,459
Age Distribution								
<18 Years Old	20%	20%	20%	21%	19%	21%	19%	21%
18 to 64 Years Old	59%	62%	60%	61%	60%	61%	61%	61%
Families								
Single Parent with Children (<18) No Spouse	7%	9%	8%	9%	7%	8%	7%	7%
Educational Attainment								
Bachelor's Degree or Higher	19%	36%	20%	31%	21%	31%	20%	37%
Other Features								
Households with No Internet Access	15%	11%	18%	14%	20%	14%	22%	15%
# Persons <65 Years with No Health Insurance	9%	5%	8%	7%	8%	7%	8%	7%
Data has been compiled from <i>School District Profiles</i> under the Demographics tab from Center for Rural Pennsylvania's website and the details are presented in Appendix 4.								

Table 8: Demographic Indicators and Student Mental Stress Levels, Rural and Urban Counties

Demographic Characteristics	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Families						
Single Parent with Children (<18) No Spouse	Weak (+)	Weak (+)	Yes (+)	-	-	-
Educational Attainment						
Some College, No Degree	Weak (+)	Weak (+)	-	-	-	-
Associate degree or less	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)
Bachelor's Degree or Higher	-	-	Weak (-)	Weak (-)	-	-
Other Features						
Households without Internet Access	Weak (+)	Weak (+)	-	Weak (+)	Weak (+)	Weak (+)

Note: "Weak" refers to the demographic indicators that are significantly but weakly correlated with the percent of students with different stress levels. A weak correlation means that the coefficient of correlation is less than 0.5. "Weak" means the coefficient of correlations is between 0.30 – 0.50, and "Yes" refers to coefficients bigger than 0.50. Appendix 5 presents the correlation between High and At-Risk stress levels and of all Demographic Indicators used in the study, along with the data sources.

Findings: Economic Indicators

A review of basic economic indicators indicates that rural counties are generally poorer. The per capita personal income is roughly \$6,000 higher in urban counties, with a large percentage of students at high and at-risk stress levels. Similarly, median household income levels, average and median rents are also higher in urban counties. Labor force participation rates are higher in urban counties for management related occupations. (See Appendix 7 for more details.)

Table 9 presents the results of correlation analysis between percent of students with high and at-risk mental stress levels, and the economic indicators. Correlation measures were estimated for the rural and urban subgroups and for the entire data.

Correlation results indicate that there are important socioeconomic forces that are closely related to the distribution of mental stress levels. In rural counties, rates of unemployment are related to youth stress across the board, one indicator of the pervasive impact of COVID-19 on the workforce and families. The percentage of students with at-risk levels of stress is also related to the number of households receiving benefits from SNAP and Supplemental Security Income.

Other indicators that children are vulnerable such as rates of childhood poverty, low birth weight, and unmarried mothers are also related to aggregate levels of student stress. It must be noted that when it comes to all these factors, they have similar if not stronger relationships in urban counties. Therefore, the socioeconomic and health factors that put

students at mental health risk are not unique to rural areas - they are the same throughout the state. The one exception may be mothers’ access to prenatal care, which is related to high stress levels in *rural* counties. This pattern is suggestive that additional research examines the potential connection between mothers’ access to rural health care and the long-term outcomes for their children.

Table 9: Correlations Between Economic Indicators and Student Stress Levels, Rural and Urban Counties

Economic Indicators	Percentage of Students with Stress Levels					
	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Unemployment Rate	Weak (+)	Weak (+)	Yes (+)	Weak (+)	Weak (+)	Yes (+)
Poverty						
Poverty Percent, Age 0-17	Weak (+)	Weak (+)	Yes (+)	Weak (+)	-	-
SNAP Recipients, as % Population	Weak (+)	Weak (+)	Yes (+)	-	-	-
Income						
Per Capita Income	-	Weak (-)	Weak (-)	-	Weak (-)	-
Households With Sup Sec Income	Weak (+)	Weak (+)	Yes (+)	Weak (+)	-	Weak (+)
Infant and Maternal Indicators						
% Babies Born with Low Birth Weight	Weak (+)	Weak (+)	Weak (+)	-	-	-
% Births to Unmarried Mothers	Weak (+)	Weak (+)	Yes (+)	-	-	Weak (+)
% Births to Mothers Receiving Medicaid	Weak (+)	Weak (+)	Weak (+)	-	-	-
% Mothers, No Prenatal Care in 1st Trimester	-	-	-	Weak (+)	Weak (+)	-

Note: “Yes” refers to the economic indicators that are significantly and strongly correlated with the percent of students with different levels of mental stress (At-Risk & High). Indicators are strongly correlated with the incidence of mental stress if the correlation statistic is greater than or equal to 0.5.

“Weak” refers to the economic indicators that are significantly but weakly correlated with the incidence of mental stress levels. “Weak” means the coefficient of correlations is between 0.30 – 0.50, and “Yes” refers to coefficients bigger than 0.50.

Data has been compiled from *School District Profiles* under the Demographics tab from Center for Rural Pennsylvania’s website and the details are presented in Appendix 8.

Appendix 9 presents the correlation results for all the Economic Characteristics used in this study.

Findings: Educational Indicators

Table 10 below presents the descriptive statistics of 10 main indicators to capture the importance of educational Indicators and their differences across rural and urban counties, based on the county's mental health distribution classification, or the percent of students with at-risk and high mental stress levels.

The average enrollment per county is 2,300 in rural counties, while in the urban counties the average enrollment is 12,000 students. The ratio of students to professional staff is higher in rural counties with a large percentage of students with high mental stress levels (1.61 in rural counties 1.38 in urban counties). The educational outcome measures, in terms of PSSA scores indicate that in urban counties, there is a larger percentage of students failing 8th grade Science and Math.

Table 10: Educational Indicators by Incidence Levels of Students with High and At-Risk Stress, Rural and Urban Counties

Educational Indicators	Stress Level/Incidence Rate							
	High Stress		At-Risk Stress		High Stress		At-Risk Stress	
	High Incidence		High Incidence		Medium Incidence		Medium Incidence	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Enrollment								
Average Enrollment per District	1919.79	7066	2709.13	12002.49	2701.69	12985.25	2324.54	16403.33
Free and Reduced Lunch Program								
% Free and Reduced Lunch	16.41%	34.41%	16.89%	23.63%	17.82%	22.73%	18.82%	20.31%
Staff/Teacher Ratio								
Ratio of Students to Professional Staff	1.61	1.38	1.46	1.59	1.43	1.53	1.47	1.28
Test Scores								
Grades 6 and 8: English (% Basic and Fail)	30.56%	42.54%	24.35%	32.17%	23.12%	29.46%	23.70%	21.73%
Grades 6 and 8: Math (% Basic and Fail)	50.23%	64.91%	41.44%	52.10%	39.88%	48.71%	40.93%	39.21%
Grade 8: Science (% Basic and Fail)	49.01%	54.24%	45.26%	48.35%	42.58%	45.56%	40.40%	36.74%
Dropout Rate								
Dropout Rate	1.10%	1.38%	1.12%	1.35%	1.07%	1.25%	1.00%	0.95%
Incidents and Bullying								
Incidents rate	0.30%	0.34%	0.29%	0.37%	0.27%	0.35%	0.24%	0.25%

In most cases, the dropout rate is lower in the rural counties. For instance, Table 10 indicates that 1.10% of rural students dropped out of school, compared to 1.38% in urban counties. Data also show that, in both the rural and urban counties the incident rate (total incidents per student, which includes misconduct, fighting, altercation, possession of a weapon, ATOD issues, etc. is higher in counties with a large incidence of at-risk mental stress levels.

Finally, the participation in Free and Reduced Lunch programs is higher in urban counties than in rural counties, particularly in those counties with a larger incidence of high and at-risk stress levels. During the sample period, the average participation rate for the Free and Reduced Lunch programs was about 16% in the rural counties, while it was about 34% for urban counties, with a large incidence of high stress levels.

Table 11 presents the results of correlation analysis between the percentage of students with at-risk and high stress levels, and educational Indicators. Correlation measures were estimated for the rural and urban subgroups and for the entire data at the county level.

In rural counties, test scores, the drop-out rate, and higher levels of misconduct are associated with higher levels of at-risk stress. This pattern is not unique to rural areas, as the same is also true in urban counties. Further, of particular concern is the finding that students' lower academic performance (based on PSSA scores for grades 6 and 8 in Math, English, and Science) is significantly and consistently correlated with percentage of students experiencing mental stress levels, for the *urban* counties. There is also some indication that student to professional staff ratios is more important in urban areas.

For the rural and urban counties in the study, academic performance emerges as the key variable that is correlated with the percentage of students with high and at-risk stress levels. In particular, academic performance is negatively related to the percentage of students with both at-risk and high mental stress levels. The relation between mental stress and lower academic performance is further explored in the next section.

Table 11: Correlation: Educational Indicators and Mental Health Stress Levels, Rural and Urban Counties

Educational Indicators	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Enrollment						
Free and Reduced Lunch						
% Free and Reduced Lunch	-	-	-	-	-	-
Staff/Teacher Ratio						
Ratio of Students to Professional Staff	-	-	Weak (+)	-	-	Weak (+)
Test Scores						
Grades 6 and 8: English (% Basic and Below Basic)	Weak (+)	-	Yes (+)	Weak (+)	-	Weak (+)
Grades 6 and 8: Math (% Basic and Below Basic)	Weak (+)	-	Yes (+)	Weak (+)	-	Weak (+)
Grade 8: Science (% Basic and Below Basic)	Weak (+)	Weak (+)	Yes (+)	Weak (+)	Weak (+)	Weak (+)
Dropout Rate						
Dropout Rate	Weak (+)	Weak (+)	Weak (+)	-	-	-
Incidents and Bullying						
Incidents rate	Weak (+)	Weak (+)	Weak (+)	-	-	-

Mental Stress and Academic Performance

Given the importance of a possible connection between mental health and academic performance, the study explored the trends in students' performance in PSSA exams in Math, English, and Science for grades 6 and 8. Statewide percentages show that the percentages of scores "below basic" or failing increased over time in Math and Science.

Specifically, the study explored more details in the trends in the percentage of students who scored poorly during the study time period, particularly, in counties which have a high percentage of students with high and at-risk mental stress levels. The relation between lower academic performance and mental stress levels is presented in Figures 6 and 7 below. Figure 6 presents the trends in the academic performance of students in those counties with high mental stress levels. Panels A and B present the percent of students, in grades 6 and 8, who scored "basic" and "below basic" in English, Math and Science, in 2019 and 2021, specifically, in counties with high incidence of high stress levels, or in those counties which have a larger percent of students with high mental stress. (No data are presented for 2017, as in that year there were no counties with high incidence levels.)

Table 12: Statewide Basic and Failure Rates on English, Math, and Science PSSA

Year	PSSA Scores					
	English-Basic	English-Fail	Math-Basic	Math-Fail	Science-Basic	Science-Fail
2017	17	4	19	19	22	21
2019	18	5	21	18	21	17
2021	23	6	20	28	22	25

Figures in panels A and B indicate that the percentage of students who scored “basic” and “below basic” has increased significantly in 2021, compared to 2019, in all these subjects, in counties which have a large percent of students experiencing high stress levels. With larger numbers of students experiencing high stress during the COVID-19 pandemic, test scores appear to have deteriorated in tandem.

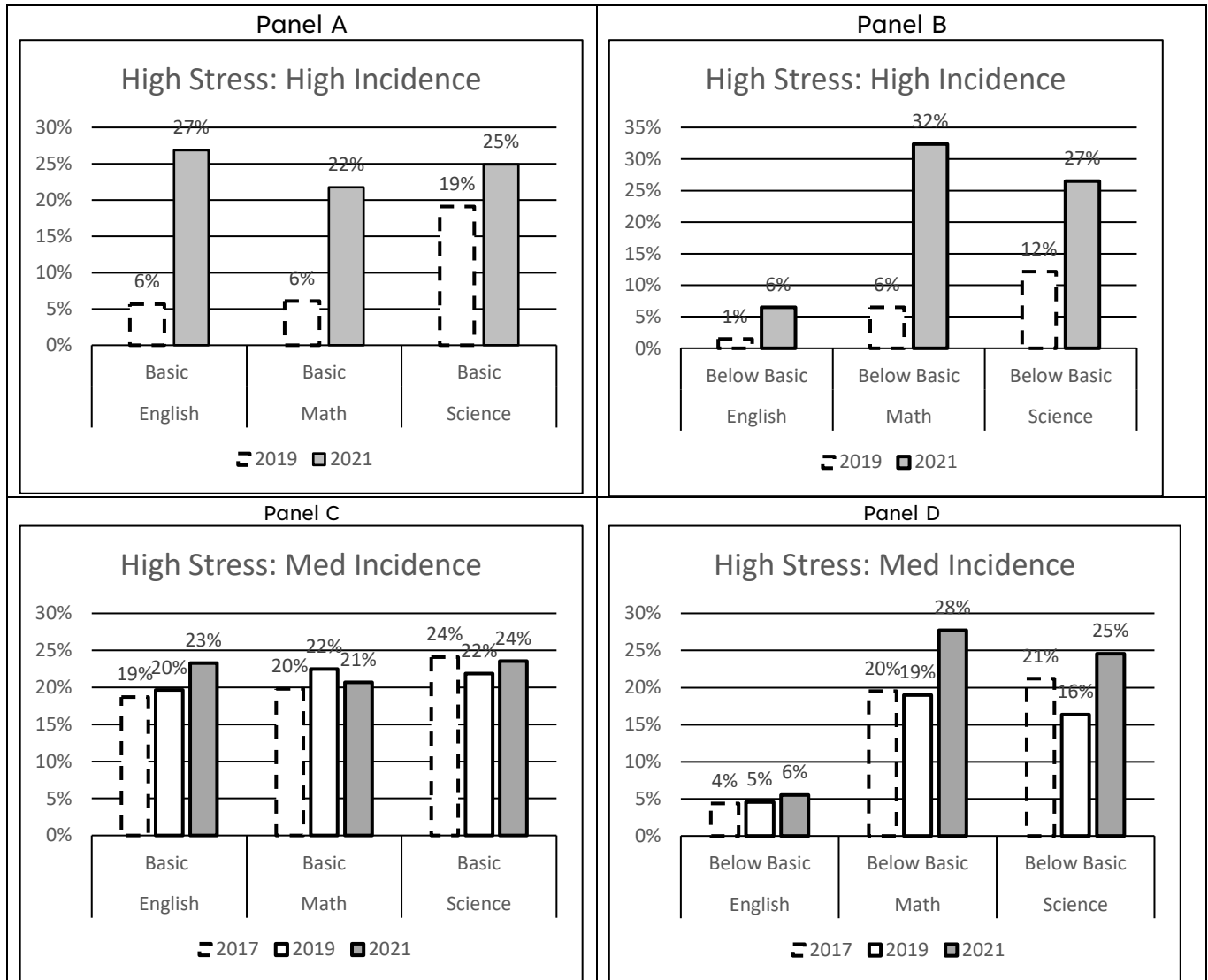
Panels C and D present the percent of students who received “basic” and “below basic” grades in English, Math, and Science in 2017, 2019 and 2021, in counties with a Medium Incidence of High Stress levels. Panel D indicates significant increases in “below basic” Math results in 2021, compared to previous years. “Basic” and “below basic” scores in other subjects have increased slightly in 2021. Thus, while the graphics show a similar pattern with panels A and B, the clear conclusion is that high stress is of particular concern for academic outcomes.

Figure 7 presents the academic performance of students in those counties with different levels of students whose responses put them at at-risk mental stress levels. Panel B shows that the percentage of students who scored “below basic” has increased significantly in 2021, compared to 2017 and 2019 in Math and Science.

Panels C and D present the percent of students who received “basic” and “fail” grades in English, Math, and Science in 2017, 2019 and 2021, in counties with a medium or moderate incidence of at-risk stress levels. Panel D indicates significant increases in “below basic” scores in Math in 2021, compared to previous years. Panel C shows significant increases in the percent of students with “basic” scores in English and Math in 2021, compared to 2017 and 2019.

Overall, the study finds that the percentage of students with lower academic performance, particularly below basic, increased significantly during COVID-19. The shape or pattern of increase is similar across all levels of stress, but the sharpest decline is evidenced in areas where the most students are coping with the highest mental stress.

Figure 6: Incidence of High Mental Stress Levels and Lower Academic Performance in English, Math, and Science



The above figures show the percent of students who scored “Basic” and “Fail” grades in PSSA Math, English and Science in Grades 6 and 8, in counties with students experiencing high mental stress levels. Panels A and B present results for counties with a large percent of students with High Stress levels, or with High Incidence. Panels C and D present the results for counties with Medium Incidence of High Stress levels. Counties where 3% to 9% of students experience High stress are treated as counties with Medium incidence of High stress. Counties where more than 9% of students experience High stress are counties with a High Incidence of High stress. PSSA scores are from PDE website. Incidence rates are derived from the composite mental health index computed in the study.

Figure 7: Incidence of At-Risk Mental Stress Levels and Lower Academic Performance in English, Math, and Science



The above figures examine the percent of students who scored “Basic” and “Below Basic” grades in PSSA Math, English and Science in Grades 6 and 8, in counties with students experiencing At-Risk mental stress levels. Panels A and B present the results for counties with a large percent of students with At-Risk Stress levels, or with High Incidence. Panels C and D present the results for counties with Medium Incidence of At-Risk Stress levels. Counties where less than 38% of students experience At-Risk stress are treated as counties with Medium incidence of At-Risk stress. Counties where more than 37% of students experience At-Risk stress are counties with a Medium Incidence of At-Risk stress. PSSA scores are from PDE website. Incidence rates are derived from the composite mental health index computed in the study.

Conclusions

This research indicated that the percentage of students with emotional and mental stress has increased in 2021, compared to 2017 and 2019 levels. For the full sample, the

percentage of students with high stress levels in 2021 has increased by 3% since 2017, while the percentage of students with at-risk stress levels in 2021 has increased by 5%.

Further, the incidence of mental stress levels is substantial in rural counties, where the percentage of students with high stress levels has increased from 4.88 in 2017 to 8.33 in 2021. At the highest end, some rural counties are dealing with close to a third of students whose responses place them at high stress.

Overall, about 49.34% of PA students in grades 6, 8, 10, and 12 are currently in the high emotionally stressed category or are in the at-risk category combined. Because the trend has moved in the direction of higher stress indicators overall, school districts and policy makers must be vigilant and monitor whether this persists in the years following the COVID-19 pandemic.

Correlation analyses indicate that some demographic variables are associated with the levels of student stress. In rural areas, lack of internet access and lower education levels of adults are related to higher stress levels at a time when students socially isolated at home needed as many resources as possible. While this is also true in urban areas because rural areas are characterized by lower levels of education and internet access, the ramifications may have a wider impact in rural counties. Not surprisingly, at-risk stress levels are also associated with higher numbers of single-parent households, where the entire burden of raising school-age children fell on one person.

Socioeconomic variables are also related to stress levels, as expected. For both rural and urban counties, higher percentages of students with at-risk stress levels are related to unemployment levels, the percent of SNAP recipients and households with supplemental security income. Infant and maternal indicators (percentage of babies born with low birth weight, percent born to unwed mothers, and childhood poverty) are also positively related to the incidence of at-risk stress levels. Such findings point toward the importance of continued monitoring of how health and economic disadvantages may be compounded by negative trends in the mental well-being of students. It is yet unclear whether the patterns witnessed during the pandemic will continue, but continuing assessment of PAYS data is warranted to determine what interventions and resources may be required and for how many students. There is no doubt that the historically high stress levels among students can have an impact on educational outcomes. In particular, in an area where many students are dealing with high stress levels, there appears to be an association with negative, steep changes in 6th and 8th grade PSSA scores. This finding suggests that policymakers concerned with the academic performance of students in school districts and the long-term outcomes, would do well to consider the numerous factors that affect the quality of students' lives and their learning environments. Findings regarding youth attitudes and behaviors indicate that addressing their mental stress may require a comprehensive and a multifaceted approach by all stakeholders in the system (parents, teachers, administration, staff, mental health professionals, social and religious organizations) to help build programming that improves students' community engagement, self-image, and confidence.

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Appendix 1

Classification in PAYS Questionnaire

Overall, the survey questions are divided into the following five broad areas:

1. Alcohol, Tobacco, and Other Drugs (ATOD) Use & Access
2. Antisocial Behavior
3. Community & Social Climate & Safety
4. Social & Emotional Health
5. Systemic Factors

The sub-categories that address specific types of risk related to youth perception, behavior, and attitudes within the five areas are:

1. Alcohol, Tobacco, and Other Drugs (ATOD) Use & Access
 - High prevalence/early initial drugs
2. Prescription & OTC drugs and medications
 - Other drugs
 - Risky substance use-related behaviors
3. Antisocial Behavior
 - Gambling
 - Other antisocial behavior
4. Community & Social Climate & Safety
 - Commitment to School
 - Involvement in pro-social activities
 - Violence/drugs on school property
 - Bullying & Internet Safety
5. Social & Emotional Health
 - Mental health concerns and suicide risk
 - Depression and substance use
 - Bullying and depression/suicide
 - Transitions & mobility, sleep, grief, and other stressful events
6. Systemic Factors
 - Perception of Risk
 - Perception of parental disapproval
 - Perception of peer disapproval
 - Attitudes toward peer use
 - Community risk associated with availability
 - Rules and antisocial behavior
 - Favorable attitudes towards drug use

Appendix 2

Questions Selected Within the Groups of the Study

The nine groups in the study along with the relevant questions used in the analysis are given below:

Commitment to School	
PAYS code	Questions
a1	During the last four weeks, how many whole days of school have you missed because you skipped or 'cut'?
a2	How important do you think the things you are learning in school are going to be for your later life?
a3	How interesting are most of your courses to you?
a4	Putting them all together, what were your grades like last year?
a5	How often do you feel that the schoolwork you are assigned is meaningful and important?
a6a	Now thinking back over the past year in school, how often did you enjoy being in school?
a6b	Now thinking back over the past year in school, how often did you hate being in school?
a6c	Now thinking back over the past year in school, how often did you try to do best work in school?
a7	Are your school grades better than the grades of most students in your class?
a8	Teachers ask me to work on special classroom projects.
a10	I have lots of chances to be part of class discussions or activities.
a11	In my school, students have lots of chances to help decide things like class activities and rules.
a12	There are lots of chances for students in my school to get involved in sports, clubs, and other school activities outside of class.
a13	My teacher(s) notices when I am doing a good job and lets me know about it.
a14	I feel safe at my school.
a16	My teachers praise me when I work hard in school.
a17	My neighbors notice when I am doing a good job and let me know.
a18	There are people in my neighborhood who are proud of me when I do something well.
a19	There are people in my neighborhood who encourage me to do my best.
Systemic Factors	
PAYS code	Questions

b1	My parents ask me what I think before most family decisions affecting me are made.
b2	If I had a personal problem, I could ask my mom or dad for help.
b5	How often do your parents tell you they're proud of you for something you've done?
b6a	Do you feel very close to your: Mother?
b6b	Do you feel very close to your: Father?
b7a	Do you share your thoughts and feelings with your: Mother?
b13	The rules in my family are clear.
b19	My family has clear rules about alcohol and drug use.
e9b	Including the last 12 months, how many times have you changed homes in the last three years?
Involvement in Pro-Social Activities	
PAYS code	Questions
e3a	In the past 12 months, in which of the following activities did you participate? Organized community activities (such as scouting, 4H, service clubs, YMCA, etc.)
e3b	In the past 12 months, in which of the following activities did you participate? Family supported activities or hobbies (such as dance, gymnastics, hiking, biking, skating, etc.)
e3c	In the past 12 months, in which of the following activities did you participate? School sponsored activities (such as sports, music, clubs, after school programs, etc.)
e3d	In the past 12 months, in which of the following activities did you participate? Faith-based activities (such as choir, youth group, mission, church leagues, etc.)
e3e	In the past 12 months, in which of the following activities did you participate? Job, employed
e3f	In the past 12 months, in which of the following activities did you participate? Volunteer
e3g	In the past 12 months, in which of the following activities did you participate? Other activities
e3h	In the past 12 months, in which of the following activities did you participate? I do not participate
c9	How often do you attend religious services or activities?
Social & Emotional Health	
PAYS code	Questions
c5	Sometimes I think that life is not worth it.
c6	At times I think I am no good at all.
c7	All in all, I am inclined to think that I am a failure.

f2c	If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Emotional abuse, insults, name-calling
f2e	If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Response: Control of what you were wearing
f3	In the past 12 months, did anyone on the Internet ever try to get you to talk online about sex, look at sexual pictures, or do something else sexual?
f1fo	If you have been bullied in the past 12 months by other students, why were you bullied? Response: My sexual orientation
Bullying & Internet Safety	
PAYS code	Questions
f1fo	If you have been bullied in the past 12 months by other students, why were you bullied? Response: My sexual orientation
f2e	If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Response: Control of what you were wearing
f2c	If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Response: Emotional abuse, insults, name-calling
f3	In the past 12 months, did anyone on the Internet ever try to get you to talk online about sex, look at sexual pictures, or do something else sexual?
Mental Health Concerns & Suicide Risk	
PAYS code	Questions
f4a	Did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?
f4b	Did you ever seriously consider attempting suicide?
f4c	Did you make a plan about how you would attempt suicide?
f4d	How many times did you actually attempt suicide?
f4e	If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning or overdose that had to be treated by a doctor or nurse?
f5	In the past 12 months, have any of your friends or family members close to you died?
Risky Substance Use-Related & other Antisocial Behavior	
PAYS code	Questions
x16c	If I used an electronic vapor product in the past year, I used it with: Nicotine

e6f	In the past 12 months, have you done anything to harm yourself (such as cutting, scraping, burning) as a way to relieve difficult feelings, or to communicate emotions that may be difficult to express verbally?
d3	In the past 30 days have you bet/gambled for money or anything of value?
d1a	In the past year, how many times have you played cards for money?
d1e	In the past year, how many times have you bet on games of skill for money?
Perception of Risk	
PAYS code	Questions
c8a	How much do you think people risk harming themselves if they take 1-2 alcoholic drinks nearly every day?
c8b	How much do you think people risk harming themselves if they drink 5 or more drinks once or twice a week?
c8c	How much do you think people risk harming themselves if they smoke one or more packs of cigarettes per day?
c8d	How much do you think people risk harming themselves if they try marijuana once or twice?
c10a	How wrong do you think it is for someone your age to stay away from school all day when their parents think they are at school?
c10b	How wrong do you think it is for someone your age to take a handgun to school?
c10c	How wrong do you think it is for someone your age to steal anything worth more than \$5?
c10d	How wrong do you think it is for someone your age to pick a fight?
c10e	How wrong do you think it is for someone your age to attack someone with the idea of seriously hurting them?
c10h	How wrong do you think it is for someone your age to use LSD, cocaine, amphetamines, or another illegal drug?
c11a	How many times have you done what feels good no matter what?
c15	I think sometimes it's okay to cheat at school.
c16	It is important to be honest with your parents, even if they become upset or you get punished.
Risk & Protective Factors	
PAYS code	Questions
crInd_rs	Risk score - Laws and norms favorable to drugs scale
frpab_rs	Risk score - Parental attitudes favor antisocial behavior
frpfm_rs	Risk score - Poor family management scale
frpfd_rs	Risk score - Parental attitudes favor drug use
sracf_rs	Risk score - School academic failure scale

srlcs_rs	Risk score - Low school commitment scale
prata_rs	Risk score - Peer-individual attitudes favorable to antisocial behavior scale
omdep_rs	Risk score - Peer-individual depression scale
prsns_rs	Peer-individual sensation seeking scale
crlna_rs	Risk score - Low neighborhood attachment scale
risk	High Level of accumulative risk
Notes: Source: PAYS data. The table shows the questions that were selected in the study to compute the multidimensional mental health index, and the mental deprivation scores.	

Appendix 3

Percentage Increases in Responses for Selected PAYS Questions Between 2021-2017 and 2021-2019 – Overall Data, Rural and Urban School Districts

School Districts	Overall		Rural		Urban	
	21-17	21-19	21-17	21-19	21-17	21-19
Differences in Frequencies Between						
Self-worth						
Sometimes I think that life is not worth it. (Response: YES)	2.31	1.9	2.03	1.7	2.6	2.08
At times I think I am no good at all (response: YES)	2.17	1.49	1.89	1.17	2.46	1.71
All in all, I am inclined to think that I am a failure (response: YES)	3.29	1.76	3.16	1.76	3.56	1.89
Perception and Awareness						
I think sometimes it's okay to cheat at school (response: YES)	2.92	1.9	2.81	2.09	3.24	1.93
It is important to be honest with your parents, even if they become upset or you get punished (response: NO)	7.01	2.07	6.64	1.87	7.21	2.31
Bullying and Internet Safety						
During the past 12 months, have you been bullied through texting and/or social media? (Response: YES)	-0.96	2.22	-0.9	1.99	-0.95	2.25
Do adults at your school stop bullying when they see/hear it or when a student tells them about it? (Response: NO!)	6.24	2.74	4.41	2.13	2.02	3.21
Do adults at your school stop bullying when they see/hear it or when a student tells them about it? (Response: no)	-0.18	2.92	-0.84	2.78	-17.27	2.9
Do adults at your school stop bullying when they see/hear it or when a student tells them about it? (Response: YES)	-2.79	6.46	-2.56	5.78	8.35	6.71
If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Threats (response: YES)	17.31	3.41	17.65	3.5	17.29	3.71
If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Emotional abuse, insults, name-calling (response: YES)	46.75	5.91	45.38	4.11	47.51	6.38
If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Isolation from friends and family (response: YES)	10.04	1.51	10.09	1.68	9.98	1.29

If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Control of what you were wearing (response: YES)	10.31	5.19	10.53	5.46	10.12	5.07
If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Control with whom you socialized (response: YES)	10.46	2.78	10.44	2.7	10.37	2.68
If you were hurt or abused by another person in the past 12 months, how were you hurt or abused? Other injury or abuse (response: YES)	7.96	-0.73	7.76	-0.3	8.04	-0.93
Self-worth & Suicide risk						
Did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities? (Response: YES)	7.01	8.62	6.6	7.89	7.48	9.08
Did you ever seriously consider attempting suicide? (Response: YES)	61.39	9.11	1.13	3.66	-66.58	4.42
Did you make a plan about how you would attempt suicide? (Response: YES)	1.25	3.39	1.03	3.1	1.58	3.62
How many times did you actually attempt suicide? (Response: 1 time)	-5.4	9.84	-6.86	8.61	-4.88	10.39
In the past 12 months, have any of your friends or family members close to you died? (Response: YES)	-3.96	4.54	-3.42	4.64	-25.27	4.51
In the past 12 months, have any of your friends or family members close to you died? (Response: NO)	-0.14	8.68	-2.36	7.07	61.38	9.46
Academic Performance						
How interesting are most of your courses to you? (Response: Slightly Dull)	3.88	2.01	3.84	2.34	3.97	1.81
Putting them all together, what were your grades like last year? (Response: Mostly C's)	2.13	2.02	1.95	1.99	2.35	2.17
Putting them all together, what were your grades like last year? (Response: Mostly D's)	2.2	2.16	2.16	2.15	2.3	2.21
How often do you feel that the schoolwork you are assigned is meaningful and important? (Response: Sometimes)	5.64	3.39	5.68	3.48	5.68	3.24
Are your school grades better than the grades of most students in your class (response: No)	3.76	2.35	3.85	2.4	3.65	2.3
Community Attachment						

Teachers ask me to work on special classroom projects (response: NO!)	4.04	1.49	4.12	1.62	4.04	1.52
Teachers ask me to work on special classroom projects (response: no)	5.32	4.41	5.3	4.12	5.29	4.46
My neighbors notice when I am doing a good job and let me know (response: NO!)	1.87	2.57	1.85	2.37	1.95	2.6
There are people in my neighborhood who are proud of me when I do something well (response: NO!)	2.3	0.34	2.3	0.75	2.33	0.28
There are people in my neighborhood who are proud of me when I do something well (response: no)	2.82	2.69	3.06	2.69	2.74	2.65
There are people in my neighborhood who encourage me to do my best (response: no)	3.25	3.02	3.49	3.11	3.16	2.99
Risk Scores						
Risk score - Parental attitudes favor antisocial behavior (index: High Risk)	6.19	3.8	5.6	3.6	6.85	4.09
Risk score - School academic failure scale (index: High Risk)	7.18	4.77	3.85	2.4	3.65	2.3
Risk score - Low school commitment scale (index: High Risk)	11.35	5.45	55.83	10.4	5.81	11.87
Risk score - Peer-individual attitudes favorable to antisocial behavior scale (index: High Risk)	7.8	4.72	7.41	4.66	8.31	5.03
Peer-individual sensation seeking scale (index: High Risk)	3.03	2.65	2.69	2.27	3.23	2.9
Risk score - Peer-individual depression scale (index: High Risk)	3.83	2.77	3.67	2.3	4.32	3.24
Risk score - Low neighborhood attachment scale (index: High Risk)	2.04	1	2.53	1.7	2.11	1.18
High Level of accumulative risk (index: High Risk)	2.02	0.53	1.95	1.46	2.21	0.34
ATOD issues						
If you drank alcohol during the past 12 months, how did you usually get it? Parents provided it to me	10.57	10.28	9.9	9.63	10.95	10.65
If you drank alcohol during the past 12 months, how did you usually get it? Friends, brothers, or sisters over 21 provided it to me	8	8.38	7.02	7.33	8.54	8.86
If you drank alcohol during the past 12 months, how did you usually get it? Friends, brothers, or sisters under 21 provided it to me	6.23	6.79	4.82	5.23	6.95	7.57

If you drank alcohol during the past 12 months, how did you usually get it? Other relatives provided it to me	5.34	5.38	5.16	5.23	5.52	5.53
If you drank alcohol during the past 12 months, how did you usually get it? Other source provided it to me	4.82	5.47	4.86	5.32	4.75	5.35
If you drank alcohol during the past 12 months, how did you usually get it? Took without permission, stole, or found it	9.32	9.2	8.52	8.21	9.8	9.69
Family Attachment						
How often do your parents tell you they're proud of you for something you've done? (Response: Never or Almost Never)	2.08	1.52	2.4	1.97	2.23	1.5
Do you share your thoughts and feelings with your: Mother? (Response: no)	2.32	1.58	2.53	1.94	2.21	1.49
Community Participation						
In the past 12 months, in which of the following activities did you participate? Organized community activities (such as scouting, 4H, service clubs, YMCA, etc.) (response: No)	5.93	4.72	4.82	3.79	6.83	5.2
In the past 12 months, in which of the following activities did you participate? School sponsored activities (such as sports, music, clubs, after school programs, etc.) (response: No)	4.58	5.15	4.49	5.31	4.97	5.62
In the past 12 months, in which of the following activities did you participate? Faith-based activities (such as choir, youth group, mission, church leagues, etc.) (response: No)	5.84	4.13	4.7	3.28	6.75	4.86
In the past 12 months, in which of the following activities did you participate? Job, employed (response: No)	3.85	2.96	4.5	2.91	3.52	2.73
In the past 12 months, in which of the following activities did you participate? Volunteer (response: No)	6.41	5.59	6.01	5.25	6.93	5.99
In the past 12 months, in which of the following activities did you participate? Other activities (response: No)	3.14	2.88	2.86	2.78	3.36	3.07
In the past 12 months, in which of the following activities did you participate? I do not participate (response: Yes)	3.99	2.01	3.36	1.75	4.55	2.52

How often do you attend religious services or activities? (Response: Never)	5.87	3.49	5.11	2.51	6.37	4.33
How often do you attend religious services or activities? (Response: Rarely)	2.74	1.99	2.41	2.13	2.94	1.92
<p>Source: PAYS data. Column 21-17 shows the increase in the percentage of a specific response between 2017 and 2021. The column 21-19 shows the increase in the percentage of a specific response between 2019 and 2021. The differences are computed after obtaining the frequencies for each year for each response. The comparisons are also reported for rural and urban subsamples, in the last four columns.</p>						

Appendix 4

The Alkire-Foster Method

The current study adopts the Alkire-Foster method to arrive at a multidimensional measure of mental-health features in a population. The following example illustrates the workings of the AF measure, in the context of mental health status. The table below presents four specific questions, related to incidence of bullying, food insecurity, self-worth, and community participation, from the PAYS data for consideration.

PAYS code	Survey Question
e1a	In the past 12 months, how often have you: Been threatened to be hit or beaten up on school property?
b24b	How many times have you? Skipped a meal because your family didn't have enough money to buy food?
c5	Sometimes I think that life is not worth it.
e3a	In the past 12 months, in which of the following activities did you participate? Organized community activities (such as scouting, 4H, service clubs, YMCA, etc.)

Valid responses for each of these questions are noted below:

e1a: In the past 12 months, how often have you: Been threatened to be hit or beaten up on school property?

- 1: Never
- 2: Once
- 3: 2 or 3 times
- 4: 4 or 5 times
- 5: 6 to 9 times
- 6: 10 or more times

b24b: How many times have you? Skipped a meal because your family didn't have enough money to buy food?

- 1: Never
- 2: I've done it, but not in the past year
- 3: Less than once a month
- 4: About once a month
- 5: 2 or 3 times a month
- 6: Once a week or more

c5: Sometimes I think that life is not worth it.

- 1: NO!
 2: no
 3: yes
 4: YES!

e3a: In the past 12 months, in which of the following activities did you participate?
 Organized community activities (such as scouting, 4H, service clubs, YMCA, etc.)

- 1: Yes
 2: No

The following table below presents the responses to the four questions noted above, from seven students. Three of the students are from rural districts, while four students are from urban districts.

PAYS code		e1a	b24b	c5	e3a
ID	Location	Bullying	Food insecurity	Self-worth	Participation
1	Rural	1	1	3	2
2	Rural	3	4	2	1
3	Rural	1	5	2	2
4	Urban	1	1	3	1
5	Urban	1	3	3	2
6	Urban	3	4	2	1
7	Urban	4	5	4	2

The steps used to construct the AF measure of multidimensional mental-health status are:

- **Step 1:** Use the deprivation cutoff vector (z) and derive the deprivation matrix, g^0 .
- **Step 2:** Use the weights assigned to each dimension, from the weight vector, w , and derive the deprivation score vector.
- **Step 3:** Use the cutoff score, k , and identify the persons who have mental health issues, using the censored deprivation score vector $c(k)$.
- **Step 4:** Compute the following indices: multidimensional headcount ratio or the incidence of mental health (H_o), intensity of mental health (A) and the adjusted headcount ratio (H).

The following computations present the workings of each step:

- **Step 1:** Assume a deprivation cutoff vector, which helps identify those students who are deprived in specific dimensions. Say that the cutoff vector $z = (2 \text{ or } 3 \text{ times, about once a month, yes, Yes})$.

Based on the information in z , the deprivation matrix, g^0 can be constructed, by assigning a mental-health deprivation status indicator equal to 1, to students who are deprived in specific dimensions, and a deprivation status indicator equal to 0, to students which are at or above the cutoff. The deprivation matrix, g^0 for the example is:

$g^0 =$	0	0	1	1
	1	1	0	0
	0	1	0	1
	0	0	1	0
	0	0	1	1
	1	1	0	0
	1	1	1	1

- **Step 2:** Assume that the dimensions are weighted equally. Then, the corresponding weights vector is, $w = (0.25, 0.25, 0.25, 0.25)$. The weights vector and the deprivation matrix yield the deprivation score vector, by multiplying each dimensional entry from g^0 with the corresponding weight.

For instance, the first student’s deprivation score is: $(0 \times 0.25) + (0 \times 0.25) + (1 \times 0.25) + (1 \times 0.25) = 0.5$. Consequently, the deprivation score vector for all seven students is: $c = (0.5, 0.5, 0.5, 0.25, 0.5, 0.5, 1)$.

- **Step 3:** This step identifies those students who have low mental health status, by establishing a cutoff score k . The intermediate cutoff, established by AF, is set at $k = 0.5$. This implies that a student faces mental health issues if the student is deprived of 50% of all the weighted dimensions. The cutoff score, k , identifies those students who have critical mental health challenges, using the censored deprivation score vector $c(k)$.

The deprivation vector, c , indicates that the fourth student has a score of 0.25, and hence, is above the cutoff threshold. The censored deprivation vector $c(k)$ uses the same deprivation score if the value is bigger than or equal to 0.5. If the score in vector $c < 0.5$, then that score in the $c(k)$ is set to 0. With these calibrations, the censored deprivation vector $c(k) = (0.5, 0.5, 0.5, 0, 0.5, 0.5, 1)$.

- **Step 4:** Compute multidimensional headcount ratio or the incidence of mental health stress (H_o), intensity of mental health stress factor (A) and the adjusted headcount ratio (H), as follows:

$H_o = \frac{q}{n}$, where q stands for the number of students, who have low mental health status, and n stands for the total sample size, and H_o represents the incidence of mental health stress in the total population
$A = \frac{\sum_{i=1}^q c_i(k)}{q}$, where A represents the intensity of mental health stress among those students that have low mental-health outcomes
$H = H_o \times A$, or the adjusted headcount ratio

Hence, the achievements matrix for the seven school students:

$H = \frac{q}{n} = \frac{6}{7} = 0.857$
$A = \frac{\sum_{i=1}^q c_i(k)}{q} = \frac{3.5}{6} = 0.58$
$M_o = H \times A = 0.857 \times 0.58 = 0.497$

Using AF’s methodology H is defined, in the context of the current study, as the multidimensional headcount ratio, also known as the multidimensional mental-health index. H is a combination of both the incidence of mental-health status (H_o) and the intensity of mental-health stress faced by the students who have low mental health outcomes in the population (A).

The uncensored headcount ratio of each dimension (h_j) indicates the proportion of students, which are deprived in that dimension. From the deprivation matrix, it is clear that 3 out of 7 or 42% of students are deprived of the mental health dimension. The uncensored headcount ratio for each of the other dimensions is 57% (or 4/7).

It is also possible to partition the students into different subgroups and identify the share of the low mental-health status among the subgroups to overall mental health. In order to identify the share of subgroup mental-health status, and their comparison to overall mental health status, the subgroup headcount ratios and population shares have to be derived. This is achieved by dividing the data into two groups, based on location (rural vs urban). A new binary variable is defined as equal to 1 for rural and 0 for urban, such that the mental-health deprivation matrix is now:

$g^o =$	0	0	1	1	1
	1	1	0	0	1
	0	1	0	1	1
	0	0	1	0	0
	0	0	1	1	0
	1	1	0	0	0
	1	1	1	1	0

The last column in g^o indicates that the sample has three rural and four urban locations. Assume different weights for the dimensions, with $w = (0.4, 0.25, 0.25, 0.1)$, with mental health status receiving the highest weight.

As before, the deprivation score vector is obtained by multiplying each dimensional entry from g^o with the corresponding weight. The first student’s deprivation score is: $(0 \times 0.40) + (0 \times 0.25) + (1 \times 0.25) + (1 \times 0.1) = 0.35$. Consequently, the deprivation score vector for all seven students is then, $c = (0.35, 0.65, 0.35 \mid 0.25, 0.35, 0.65, 1)$. The line $|$, represents subgroup partition.

With the cutoff at $k = 0.5$, the censored deprivation vector is: $c = (0, 0.65, 0 \mid 0, 0, 0.65,$

1). The table below summarizes the adjusted headcount ratio for the two subgroups, and for the whole sample.

	Rural (location = 0)	Urban (location = 1)	Total
$H = \frac{q}{n}$	$2/4 = 0.5$	$1/3 = 0.33$	$3/7 = 0.428$
$A = \frac{\sum_{i=1}^q c_i(k)}{q}$	$1.65/2 = 0.825$	0.65	$A = \frac{0.65 + 0.65 + 1}{7} = 0.766$
$H = H_o \times A$	$0.5 \times 0.825 = 0.4125$	$0.33 \times 0.65 = 0.214$	$0.428 \times 0.766 = 0.327$
Population share	$4/7 = 0.57$	$3/7 = 0.43$	100%

The Adjusted Headcount Ratio for rural students is larger than that for students from urban districts. This aspect is also highlighted by this group’s contribution to the overall Adjusted Headcount Ratio. The contribution of each subgroup to overall H , depends upon the subgroup’s Adjusted Headcount Ratio weighted by its population share (v_i) as follows:

$$Rural: D_0 = \frac{H \times v_0}{H} = \frac{0.4125 \times 0.57}{0.327} = 0.72$$

$$Urban: D_1 = \frac{H \times v_1}{H} = \frac{0.214 \times 0.43}{0.327} = 0.28$$

Since each student’s deprivation score vector $c = (0.35, 0.65, 0.35 | 0.25, 0.35, 0.65, 1)$, and the cutoff value is $k = 0.5$. Hence, the first, third, fourth and fifth respondents do not have mental-health issues, because their deprivation scores are less than the cutoff. Using this consideration, the transformed uncensored deprivation matrix, g^o , provides a censored deprivation matrix, $g^o(k)$:

	Bullying	Food Insecurity	Self-worth	Participation
$g^o(k) =$	0	0	0	0
	1	1	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
	1	1	0	0
	1	1	1	1

The new censored deprivation matrix, $g^o(k)$, provides a censored headcount ratio, $h_i(k)$, in each dimension. The table below summarizes the values of the uncensored, and the censored headcount ratios, h_i and $h_i(k)$, for each dimension.

	Bullying	Food Insecurity	Self-worth	Participation
h_i	0.42	0.57	0.57	0.57
$h_i(k)$	0.42	0.42	0.14	0.14
W	0.4	0.25	0.25	0.1
$\varphi^0(k)$	0.51	0.32	0.10	0.04

The first row presents the uncensored headcount ratio (h_i) in each dimension, which is derived from the original achievements' matrix. Recall, that from the uncensored deprivation matrix g^0 , 42% of students are deprived in the "Bullying" dimension. The censored headcount ratios, along with the weights, w , provides, $\varphi^0(k)$, or the percentage contribution of each dimension to the overall Adjusted Headcount Ratio. Consider the mental health dimension, with a censored headcount ratio of 0.42, and with a weight of 0.4. The contribution of the mental health status dimension to the Adjusted Headcount Ratio is $(0.42 \times 0.4)/0.327 = 0.51$, or 51%. Likewise, the contribution of the food-insecurity dimension is $(0.42 \times 0.25)/0.327 = 0.32 = 32\%$. Note that while the censored headcount ratio for Self-Worth and Participation are the same, the contribution of Self-Worth to the overall Adjusted Headcount Ratio is only 4%, which is much smaller than the role of Mental Health status, a natural consequence of the relative weights attached to each of these corresponding dimensions.

The current study adopted the AF method to derive the Adjusted Headcount Ratio (H) of nine key domains and found the mean Adjusted Headcount Ratio for school districts based on rural and urban subsamples, and for subsamples covering two different time periods. Further, a weighted average of the questions from the nine domains was computed to arrive at the Deprivation Score (M).

The nine domains considered in the study are:

- Commitment to School
- Systemic Factors
- Involvement in Pro-Social Activities
- Social & Emotional Health
- Bullying & Internet Safety
- Mental Health Concerns & Suicide Risk
- Risky Substance Use-Related & other Antisocial Behavior
- Perception of Risk
- Risk & Protective Factors

The Deprivation Score M was computed as follows:

- Step 1: Each deprivation in a specific domain was weighted by the number of questions selected in that specific domain.
- Step 2: The sum of all the weighted deprivation scores across all 9 domains was obtained.

- Step 3: The Deprivation score M was set equal to the weighted average deprivation (total weighted deprivation divided by 9).

A Deprivation Score (M) was computed for every student in the study. The Deprivation Score (M) was used to classify the students into three different “types”:

- Type 1: “Low” ($M < 0.27$): students with relatively low deprivation score
- Type 2: “Medium” ($0.27 \leq M \leq 0.5$): students exposed to moderate levels of deprivation.
- Type 3: “High” ($M > 0.5$): students experiencing high deprivation scores.

The percentage of students for every school district for every year within the above M categories can be calculated from the Deprivation Score computations. Therefore, the number of students falling under each type of class was used to classify the school districts, according to the incidence of their psychological and emotional status, or percentage of students falling under different, “Risk” categories. The three “Risk” categories for schools based on the percentage of students experiencing High Deprivation Scores are:

- Risk “Low”: If % of students with “High” M score < 10
- Risk “Medium”: $10 < \%$ of students with “High” M score ≤ 12
- Risk “High”: If % of students with “High” M score > 12

Similarly, the three “Risk” categories for schools based on the percentage of students experiencing Medium Deprivation Scores are:

- Risk “Low”: If % of students with “Medium” M score ≤ 30
- Risk “Medium”: $30 < \%$ of students with “Medium” M score ≤ 50
- Risk “High”: If % of students with “Medium” M score > 50

Appendix 5

Programs and Initiatives in Pennsylvania

The Commonwealth of PA has established services and resources to protect the mental health of its citizens, particularly, rural youth:

- <https://www.health.pa.gov/topics/disease/coronavirus/Pages/Guidance/Mental-Health.aspx>

From the Mental Health Association in PA covering Rural Mental Health, “Reach Out PA”, “Suicide Prevention Task Force”, “Training for First Responders”, “Trauma-Informed PA” etc.

- <https://www.mhapa.org/rural-mental-health-first-aid/>
- <https://www.mhapa.org/children-youth/organizations-for-children-youth/>

Other related Programs in PA that address youth mental health:

Integrated Children’s Services

- <https://www.dhs.pa.gov/Services/Children/Pages/Integrated-Children%27s-Services.aspx>

Bureau of Children’s Behavioral Health Services

- <https://www.dhs.pa.gov/contact/DHS-Offices/Pages/OMSHAS-Childrens%20Behavioral%20Health%20Services.aspx>
- Intensive Behavioral Health Services
<http://www.healthchoices.pa.gov/providers/about/behavioral/inbehavioralhs/index.htm>

School-Based Behavioral Health

- <https://www.dhs.pa.gov/Services/Mental-Health-In-PA/Pages/School-Based-Behavioral-Health.aspx> (There are quite a few programs under this umbrella.)

Student Assistance Program (SAP)

- <https://www.dhs.pa.gov/Services/Assistance/Pages/Student-Assistance-Program.aspx>

Appendix 6

Demographic Characteristics of the Percentage of Students in High and At-Risk Stress Levels, Rural and Urban Counties

Demographic Characteristics	Stress Level/Incidence Rate							
	High Stress		At-Risk Stress		High Stress		At-Risk Stress	
	High Incidence		High Incidence		Medium Incidence		Medium Incidence	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Population								
Total Population	56,257	759,010	74,704	407,892	76,820	416,912	69,837	512,459
Age Distribution								
<18 Years Old	20%	20%	20%	21%	19%	21%	19%	21%
18 to 64 Years Old	59%	62%	60%	61%	60%	61%	61%	61%
65+ Years Old	22%	19%	21%	18%	20%	18%	20%	18%
Racial Breakdown								
White 2017 -21	93%	80%	92%	78%	92%	79%	92%	82%
Black or African American	2%	10%	3%	7%	3%	7%	3%	6%
Other Races	1%	3%	1%	3%	1%	3%	1%	4%
Two or More Races	2%	3%	2%	2%	1%	2%	1%	2%
Hispanic or Latino (Any Race)	2%	4%	3%	10%	3%	9%	3%	6%
Families								
Single Parent with Children (<18) No Spouse	7%	9%	8%	9%	7%	8%	7%	7%
Single Person Households (Living Alone)	28%	34%	29%	28%	29%	28%	29%	28%
Married Couples with Children (<18)	15%	15%	16%	18%	16%	18%	16%	20%
Married Couples with No Children (<18)	36%	28%	35%	31%	35%	32%	36%	33%
Other Types of Households	13%	15%	13%	14%	13%	14%	12%	13%
Educational Attainment								
No High School Diploma	10%	7%	10%	9%	11%	9%	11%	8%
High School Diploma or GED	46%	32%	45%	35%	45%	34%	45%	31%
Some College No Degree	16%	16%	16%	16%	15%	16%	15%	16%
Associate degree	9%	10%	9%	9%	9%	9%	8%	8%
Bachelor's Degree or Higher	19%	36%	20%	31%	21%	31%	20%	37%
Other Features								
Households with No Internet Access	15%	11%	18%	14%	20%	14%	22%	15%

# Persons <65 Years with No Health Insurance	9%	5%	8%	7%	8%	7%	8%	7%
Total Local Revenue (Adj for Inflation)	41%	50%	44%	57%	45%	59%	44%	67%
Total State Revenue (Adj for Inflation)	50%	41%	50%	37%	49%	35%	49%	30%
Total Fed & Other Rev (Adj for Inflation)	9%	10%	7%	6%	7%	5%	7%	3%

Data has been compiled from 2017, 2019 and 2021 (5-year average) ACS (American Community Survey), U.S. Census Bureau, PA Department of Education (Sources of School District Revenues) aggregated to the county level and adjusted for inflation (base year 2021 = 100).

Appendix 7

Correlation: Demographic Indicators and the Percentage of Students with At-Risk and High Mental Stress Levels, Rural and Urban Counties

Demographic Indicators	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Population						
Total Population	-	-	-	Weak (-)	-	-
Age Distribution						
<18 Years Old	Weak (+)	-	-	-	-	-
18 to 64 Years Old	Weak (-)	Weak (-)	-	Weak (-)	Weak (-)	Weak (-)
65+ Years Old	-	Weak (+)	-	Weak (+)	Weak (+)	Weak (+)
Racial Breakdown						
White	Weak (-)	-	Weak (-)	Weak (+)	-	-
Black or African American	-	-	-	Weak (-)	-	-
Other Races	-	Weak (-)	Weak (-)	Weak (-)	-	Weak (-)
Two or More Races	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)
Hispanic or Latino- (Any Race)	Weak (+)	Weak (+)	Weak (+)	-	-	-
Married Couples with Children (<18)	-	-	Weak (-)	Weak (-)	-	Weak (-)
Married Couples with - Children (<18)	-	-	Weak (-)	-	-	-
Families						
Single Parent with Children (<18) - Spouse	Weak (+)	Weak (+)	Yes (+)	-	-	-
Single Person Households (Living Alone)	-	Weak (-)	-	-	-	-
Other Types of Households	Weak (+)	-	Yes (+)	-	-	Weak (+)
Educational Attainment						
- High School Diploma	-	-	-	-	-	-
High School Diploma, or GED	-	-	Weak (+)	Weak (+)	-	Weak (+)
Some College, No Degree	Weak (+)	Weak (+)	-	-	-	-
Associate degree	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)	Weak (+)
Bachelor's Degree or Higher	-	-	Weak (-)	Weak (-)	-	-
Revenues						

Total Local Revenue (Adj for Inflation)	-	-	Weak (-)	Weak (-)	-	Weak (-)
Total State Revenue (Adj for Inflation)	-	-	Weak (+)	-	-	Weak (+)
Total Fed & Other Rev (Adj for Inflation)	Weak (+)	-	Yes (+)	Weak (+)	Weak (+)	Weak (+)
Other Features						
Households with - Internet Access	Weak (-)	Weak (-)	-	Weak (-)	Weak (-)	Weak (-)
# Persons <65 Years With - Health Insurance	-	-	-	-	-	-

“Yes” refers to the demographic indicators that are significantly and strongly correlated with the percent of students with different levels stress (At-Risk and High). Indicators are strongly correlated with the incidence of mental stress levels if the correlation statistic is greater than or equal to 0.5.

“Weak” refers to the demographic indicators that are significantly but weakly correlated with the percent of students with different stress levels. A weak correlation means that the coefficient of correlation is less than 0.5. Data has been compiled from 2017, 2019 and 2021 (5-year average) ACS (American Community Survey), U.S. Census Bureau, PA Department of Education (Sources of School District Revenues) aggregated to the county level and adjusted for inflation (base year 2021 = 100).

Appendix 8

Detailed Table 10: ANOVA: Demographic Indicators and Incidence of At-Risk and High Mental Stress Levels, Rural and Urban Counties

Demographic Indicators	High Stress Levels			At-Risk Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Population						
Total Population	-	-	-	-	-	-
Age Distribution						
<18 Years Old	-	Yes	-	Yes	-	-
18 to 64 Years Old	Yes	Yes	-	Yes	Yes	Yes
65+ Years Old	Yes	Yes	-	-	-	-
Racial Breakdown						
White	-	-	-	-	-	-
Black or African American	-	Yes	-	-	-	-
Other Races	Yes	-	-	-	-	Yes
Two or More Races	-	Yes	-	Yes	Yes	-
Hispanic or Latin- (Any Race)	-	-	-	Yes	-	Yes
Married Couples with Children (<18)	-	Yes	Yes	-	-	Yes
Married Couples with - Children (<18)	-	-	-	Yes	-	Yes
Families						
Single Parent with Children (<18) - Spouse	-	-	-	Yes	Yes	Yes
Single Person Households (Living Alone)	-	Yes	-	-	-	-
Other Types of Households	-	-	-	Yes	-	Yes
Educational Attainment						
- High School Diploma	-	-	-	-	Yes	-
High School Diploma, or GED	-	-	Yes	-	-	Yes
Some College, - Degree	-	-	-	Yes	-	-
Associate degree	Yes	Yes	Yes	Yes	Yes	-
Bachelor's Degree or Higher	Yes	-	Yes	-	-	Yes
Other Features						
Households with - Internet Access	Yes	Yes	-	Yes	Yes	-
# Persons <65 Years With - Health Insurance	-	-	-	-	-	-

Total Local Revenue (Adj for Inflation)	Yes	-	Yes	-	-	Yes
Total State Revenue (Adj for Inflation)	-	-	-	-	-	Yes
Total Fed & Other Revenue (Adj for Inflation)	Yes	Yes	Yes	-	-	Yes
<p>“Yes” refers to the indicators that are significantly different between the districts with low, medium, and high percentages of students with at-risk and high mental stress levels, at the 0.05 level. Data has been compiled from 2017, 2019 and 2021 (5-year average) ACS (American Community Survey), U.S. Census Bureau, PA Department of Education (Sources of School District Revenues) aggregated to the county level and adjusted for inflation (base year 2021 = 100).</p>						

Appendix 9

Differences Between Economic Characteristics by the Percentage of Students in High and At-Risk Stress Levels, Rural and Urban Counties

Economic Characteristics	Stress Level/Incidence Rate							
	High Stress		At-Risk Stress		High Stress		At-Risk Stress	
	High Incidence		High Incidence		Medium Incidence		Medium Incidence	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Unemployment								
Unemployment Rate (CWIA)	6%	7%	6%	5%	6%	5%	5%	4%
Poverty								
Poverty Percent, All Ages (SAIPE)	13%	14%	13%	11%	13%	10%	13%	9%
Poverty Percent, Age 0-17 - 21 (SAIPE)	19%	19%	18%	16%	18%	15%	18%	11%
Cash Assistance as % Population, June (DHS)	0.29%	0.63%	0.46%	0.52%	0.47%	0.51%	0.44%	0.47%
SNAP Recipients, as % Population (DHS)	13%	16%	14%	13%	13%	12%	12%	9%
Income								
Per Capita Income (Adj.) (ACS)	\$ 30	\$ 36	\$ 30	\$ 36	\$ 29	\$ 37	\$ 28	\$ 41
Median Household Income (Adj.) (SAIPE)	\$ 57	\$ 62	\$ 57	\$ 70	\$ 57	\$ 72	\$ 56	\$ 81
Households With Earnings (W & S) Income (ACS)	70%	75%	71%	76%	71%	77%	70%	78%
Households With Social Security Income (ACS)	42%	35%	41%	35%	41%	35%	41%	34%
Households With Sup Sec Income (SSI) (ACS)	6%	6%	6%	5%	6%	5%	6%	4%
Households With Public Assistance Income (ACS)	3%	3%	3%	3%	3%	3%	3%	2%
Infant Mortality & Low Birth Weight								
% Babies Born with Low Birth Weight (DOH)	8%	9%	8%	8%	8%	8%	7%	8%
% Births to Unmarried Mothers (DOH)	42%	44%	43%	42%	41%	40%	38%	32%
% Births to Mothers Receiving Medicaid (DOH)	35%	34%	37%	35%	35%	33%	33%	25%

% Mothers, - Prenatal Care, 1st Tri (DOH)	29%	16%	27%	25%	26%	25%	25%	23%
Housing								
Median Gross Rent (Adj.) ACS)	\$ 768	\$ 875	\$ 777	\$ 994	\$ 777	\$ 1,014	\$ 765	\$ 1,107
Average Gross Rent (Adj.) (ACS)	\$ 702	\$ 910	\$ 723	\$ 1,003	\$ 732	\$ 1,024	\$ 723	\$ 1,124
Owners-Occupied (ACS)	76%	66%	76%	70%	75%	70%	74%	72%
Renter-Occupied (ACS)	24%	34%	24%	30%	25%	30%	26%	28%
Single Family Units (Detached 1 Unit) (ACS)	76%	65%	74%	60%	73%	60%	73%	61%
Occupations								
Management Occupations (ACS)	30%	43%	31%	38%	31%	38%	31%	42%
Service Occupations (ACS)	18%	18%	18%	17%	18%	17%	19%	15%
Commuting Time								
Avg. Commuting Time (Minutes) (ACS)	27.0	23.3	26.4	24.9	25.6	25.3	24.7	26.2

ACS: 2017, 2019, and 2021 5-years Average, American Community Survey, U.S. Census Bureau

SAIPE: 2017, 2019, and 2021 Small Area Income and Poverty Estimates, U.S. Census Bureau

DHS: Pennsylvania Department of Human Services

CWIA: Center for Workforce Information and Analysis, Pennsylvania Department of Labor and Industry

LEHD: Longitudinal Employer-Household Dynamics, U.S. Census Bureau

DOH: Pennsylvania Department of Health

The 2020 birth and infant mortality data is the most recent.

All income and rent data are adjusted for inflation (base year 2021 = 100). Income is in thousands of dollars.

Appendix 10

Variables and Data Sources

1. (PAYS) Pennsylvania Youth Survey (<http://episcenter.psu.edu/pays>) reports on indicators of youth mental health (request information at the school district level) which provides additional information on mental health status and mental health distribution.

School-District Characteristics

1. The Pennsylvania System of School Assessment (PSSA) test scores in Math & Reading competencies
2. Percent of students eligible for free and reduced lunch under NSLP
3. Total enrollment in each school, the number of professional and support staff (to compute student/teacher ratio)
4. Student Drop-out rate, and Postsecondary participation rate.
5. Incident rates and bullying-incident ratios.

Data Sources:

1. The PA Dept of Education provides information on students' academic achievement derived from The Pennsylvania System of School Assessment (PSSA) test scores in Math & Reading competencies. Information about the percentage of students who are Advanced, Proficient, Basic, and Below Basic levels is provided for every school within the district, for grades 3 to 8. The schools within each district can be aggregated to arrive at the school-district level information. (The link: <https://www.education.pa.gov/DataAndReporting/Assessments/Pages/PSSA-Results.aspx> <https://www.education.pa.gov/K-12/Assessment%20and%20Accountability/SAT-ACT/Pages/default.aspx>)
- Reports for 2020, 2021, and 2022 not provided due to changes in testing requirements and populations.
2. The PA Department of Education (Food and Nutrition tab) has detailed information on NSLP in the Building Data Report. The specific schools belonging to a particular district can be aggregated to arrive at the district level data. This information is also in *School District Profiles* from Center for Rural Pennsylvania's (under the Demographics tab). The study proposes to use the most recent year for which the data is available.
(Link: <https://www.education.pa.gov/Teachers%20-%20Administrators/Food-Nutrition/reports/Pages/National-School-Lunch-Program-Reports.aspx>)
3. The Pennsylvania Department of Education ("Data and Statistics" tab) provides information on total enrollment in each school and on the number of professional and support staff by school district (to compute student/teacher ratio):
<https://www.education.pa.gov/DataAndReporting/Enrollment/Pages/PublicSchEnrReports.aspx> <https://www.education.pa.gov/DataAndReporting/ProfSupPers/Pages/ProfPersIndStaff.aspx#>
4. The PA Department of Education (the "Data and Statistics" tab) provides data on secondary-level students who drop out of school, which can be aggregated to the district level. Postsecondary reports that provide information on intended post-high school activity of graduates, including college bound students are also available under "Graduates" (the "Data and Statistics" tab).
(Link: <https://www.education.pa.gov/DataAndReporting/Dropouts/Pages/default.aspx>)

5. Incident rates and bullying-incident ratios: Information on bullying is from the Pennsylvania Department of Education (<https://www.safeschools.pa.gov/Main.aspx?App=6a935f44-7cbf-45e1-850b-e29b2f1ff17f&Menu=dbd39a1f-3319-4a75-8f69-d1166dba5d70&res>)

provides data on various incidents such as aggravated assaults, drug possession, etc. Data was collected for the years 2016-17, 2018-19 and 2020-21. All schools within a district were aggregated to arrive at the district-level observation for each year. Incident rates for each district for each year are defined as the total number of reported incidents divided by enrollment, or the number of incidents per student. The bullying-incident ratio is the number of bullying incidents divided by total incidents, and this ratio is computed for every year for every school district.

Economic Factors

1. Poverty Estimates by county
2. Housing values, real estate market values, median household income, per capita income, percentage of children/adults with/without health insurance, school enrollment and school district expenditures
3. Percentage employed in different occupations, unemployment rate, commuting time
4. Infant mortality and birth weight status
5. Aid Ratios (market value, income aid), Average Daily Membership, equalized mills, population per square mile, total and per-student expenses, personal income of the residents of the school district, and the real estate tax rates.

Data Sources:

Data collected by the U.S. Census Bureau and can accessed from *School District Profiles* under the Demographics tab from Center for Rural Pennsylvania's website.

5. Financial Data Elements for schools under the "School Finances" tab from the PA Department of Education, given at the school district level. Aid Ratios (market value, income aid) representing relative wealth in relation to the state average, for each pupil in a school district. There is also information on Average Daily Membership (number of pupils for whom the district is financially responsible), equalized mills, population per square mile, total and per-student expenses, personal income of the residents of the school district, and the real estate tax rates. (Link:

<https://www.education.pa.gov/Teachers%20-%20Administrators/School%20Finances/Finances/FinancialDataElements/Pages/default.aspx>)

Socio-Demographic Factors

1. Housing, population in occupied housing, household size, householder type, race, age, and gender
2. Race/ethnicity, age cohorts, number of households and families, types of households, and adult educational attainment
3. Household with no internet access and households without health insurance

Data Sources:

Data on socio-economic characteristics are collected by the U.S. Census Bureau and can accessed from *School District Profiles* under the Demographics tab from Center for Rural Pennsylvania's website.

Appendix 11

Correlation Between Economic Indicators and the Percent of Students with At-Risk and High Mental Stress Levels, Rural and Urban Counties

Economic Indicators	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Unemployment Rate (CWIA)	Weak (+)	Weak (+)	Yes (+)	Weak (+)	Weak (+)	Yes (+)
Poverty						
Poverty Percent, All Ages (SAIPE)	-	Weak (-)	Yes (+)	-	-	Weak (+)
Poverty Percent, Age 0-17 (SAIPE)	Weak (+)	Weak (+)	Yes (+)	Weak (+)	-	-
Cash Assistance as % Population, June (DHS)	-	-	-	Weak (-)	Weak (-)	-
SNAP Recipients, as % Population (DHS)	Weak (+)	Weak (+)	Yes (+)	-	-	-
Income						
Per Capita Income (Adj.) (ACS)	-	Weak (+)	Weak (-)	-	Weak (+)	-
Median Household Income (Adj.) (SAIPE)	-	-	Weak (-)	Weak (-)	-	Weak (-)
Households With Earnings (W & S) Income (ACS)	-	-	Weak (-)	-	-	Weak (-)
Households With Social Security Income 2017 (ACS)	-	-	Weak (+)	Weak (+)	-	Weak (+)
Households With Sup Sec Income (SSI) (ACS)	Weak (+)	Weak (+)	Yes (+)	Weak (+)	-	Weak (+)
Households With Public Assistance Income (ACS)	Weak (+)	Weak (+)	Yes (+)	Weak (+)	-	Weak (+)
Infant Mortality & Birth Weight						
% Babies Born with Low Birth Weight (DOH)	Weak (+)	Weak (+)	Weak (+)	-	-	-
% Births to Unmarried Mothers (DOH)	Weak (+)	Weak (+)	Yes (+)	-	-	Weak (+)
% Births to Mothers Receiving Medicaid (DOH)	Weak (+)	Weak (+)	Weak (+)	-	-	-
% Mothers, - Prenatal Care in 1st Tri (DOH)	-	-	-	Weak (+)	Weak (+)	-
Housing						

Median Gross Rent (Adj.) (ACS)	-	-	Weak (-)	Weak (-)	-	Weak (-)
Average Gross Rent (Adj.) (ACS)	-	-	Weak (-)	Weak (-)	-	Weak (-)
Owners-Occupied (ACS)	-	Weak (+)	Weak (-)	Weak (+)	Weak (+)	-
Renter-Occupied (ACS)	-	Weak (-)	Weak (+)	Weak (-)	Weak (-)	-
Single Family Units (Detached 1 Unit) (ACS)	-	Weak (+)	-	Weak (+)	-	-
Occupations						
Management Occupations (ACS)	-	-	Weak (-)	Weak (-)	-	-
Service Occupations (ACS)	-	-	Yes (+)	-	-	-
Commuting time						
Avg. Commuting Time (Minutes) (ACS)	Weak (+)	Weak (+)	-	-	-	-

“Yes” refers to the economic indicators that are significantly and strongly correlated with the percent of students with different levels of mental stress (At-Risk & High). Indicators are strongly correlated with the incidence of mental stress if the correlation statistic is greater than or equal to 0.5.

“Weak” refers to the economic indicators that are significantly but weakly correlated with the incidence of mental stress levels. A weak correlation means that the coefficient of correlation is less than 0.5.

ACS: 2017, 2019, and 2021 5-years Average, American Community Survey, U.S. Census Bureau

SAIPE: 2017, 2019, and 2021 Small Area Income and Poverty Estimates, U.S. Census Bureau

DHS: Pennsylvania Department of Human Services

CWIA: Center for Workforce Information and Analysis, Pennsylvania Department of Labor and Industry

LEHD: Longitudinal Employer-Household Dynamics, U.S. Census Bureau

DOH: Pennsylvania Department of Health

The 2020 birth and infant mortality data is the most recent.

All income and rent data are adjusted for inflation (base year 2021 = 100). Income is in thousands of dollars.

Appendix 12

Detailed Table 13: ANOVA: Economic Indicators and Incidence of At-Risk and High Mental Health Stress Levels, Rural and Urban Counties

Economic Indicators	High Stress Levels			At-Risk Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Unemployment Rate (CWIA)	-	Yes	Yes	-	-	Yes
Poverty						
Poverty Percent, All Ages (SAIPE)	-	Yes	-	-	-	Yes
Poverty Percent, Age 0-17 (SAIPE)	-	Yes	-	-	-	Yes
Cash Assistance as % Population, June (DHS)	-	-	-	Yes	-	-
SNAP Recipients, as % Population (DHS)	-	Yes	-	-	-	Yes
Income						
Per Capita Income (Adj.) (ACS)	-	Yes	Yes	-	Yes	Yes
Median Household Income (Adj.) (SAIPE)	-	Yes	Yes	-	-	Yes
Households With Earnings (W & S) Income (ACS)	-	Yes	-	-	-	-
Households With Social Security Income (ACS)	-	Yes	-	-	-	-
Households With Sup Sec Income (SSI) (ACS)	Yes	-	Yes	Yes	-	Yes
Households With Public Assistance Income (ACS)	-	-	Yes	Yes	Yes	Yes
Infant Mortality & Birth Weight						
% Babies Born with Low Birth Weight (DOH)	-	-	Yes	Yes	Yes	-
% Births to Unmarried Mothers (DOH)	-	-	-	Yes	Yes	Yes
% Births to Mothers Receiving Medicaid (DOH)	-	-	-	-	-	Yes
% Mothers, - Prenatal Care in 1st Tri (DOH)	Yes	Yes	-	-	-	-
Housing						
Median Gross Rent (Adj.) (ACS)	-	-	Yes	-	-	-
Average Gross Rent (Adj.) (ACS)	-	-	-	-	-	-
Owners-Occupied (ACS)	-	-	-	-	Yes	-
Renter-Occupied (ACS)	-	-	-	-	Yes	-
Single Family Units (Detached 1 Unit) (ACS)	Yes	-	-	-	-	-

Occupations						
Management Occupations (ACS)	-	-	Yes	-	-	Yes
Service Occupations (ACS)	-	Yes	Yes	-	-	Yes
Commuting Time						
Avg. Commuting Time (Minutes) (ACS)	-	-	-	-	Yes	-
<p>“Yes” refers to the indicators that are significantly different between the districts with low, medium, and high percentages of students with At-Risk and High mental stress levels, at the 0.05 level.</p> <p>ACS: 2017, 2019, and 2021 5-years Average, American Community Survey, U.S. Census Bureau</p> <p>SAIPE: 2017, 2019, and 2021 Small Area Income and Poverty Estimates, U.S. Census Bureau</p> <p>DHS: Pennsylvania Department of Human Services</p> <p>CWIA: Center for Workforce Information and Analysis, Pennsylvania Department of Labor and Industry</p> <p>LEHD: Longitudinal Employer-Household Dynamics, U.S. Census Bureau</p> <p>DOH: Pennsylvania Department of Health</p> <p>The 2020 birth and infant mortality data is the most recent.</p> <p>All income and rent data are adjusted for inflation (base year 2021 = 100).</p>						

Appendix 13

ANOVA: Educational Indicators and Incidence of At-Risk and High Mental Stress Levels, Rural and Urban Counties

Educational Indicators	At-Risk Stress Levels			High Stress Levels		
	Overall	Rural	Urban	Overall	Rural	Urban
Enrollment						
Average Enrollment per District	-	-	-	Yes	-	-
Free & Reduced Lunch (2005 – 2016)						
# Free and Reduced Lunch	-	-	-	-	-	-
% Free and Reduced Lunch	-	-	-	-	-	-
Staff/Teacher Ratio (2017 - 21)						
Ratio of Students to Professional Staff	-	-	Yes	-	-	-
Test Scores (2017 - 21)						
Grades 6 & 8: English (% Basic and Fail)	Yes	-	Yes	-	-	-
Grades 6 & 8: Math (% Basic and Fail)	-	-	Yes	-	-	-
Grade 8: Science (% Basic and Fail)	Yes	Yes	Yes	Yes	Yes	Yes
Dropout Rate (2017 - 21)						
# Dropout	Yes	-	-	-	-	-
Dropout Rate	Yes	-	Yes	-	-	-
Incidents & Bullying (2017 - 21)						
Incidents rate	Yes	Yes	Yes	-	-	-

Note: For data sources see Appendix 8. “Yes” refers to those indicators that are statistically significant across the respective county. For instance, the average percentage of students who received a Basic or a Fail grade in science is statistically different across counties with different levels of stress levels, and this difference in the average failure rate is not due to chance.

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