Mental Health's Impact on Quality of Life

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Abstract

Multitudes of epidemiological factors contribute to the resultant effects in the mental health of adolescents, defined by the World Health Organization as between ages of 10 to 19. Presently, both prevailing aspects, including the occuring Covid-19 pandemic and the subsequent social lockdown, and inherent social determinants like certain academic environments, poverty, chronic loneliness, and lack of available treatment or research influence the state of adolescent mental health. This literature review seeks to identify critical determinants of adolescent mental health and study their long term influence on mental health epidemiology as a whole. By compiling a plethora of various case studies from publications on PubMed and MEDLINE, APA PsycInfo, and PLOS One along with data from important surveys such as Youth Self Report, Adult Self Report, and TRacking Adolescents' Individual Lives Survey, this study generates a comprehensive overview of facets underlying the current trends in specifically adolescent mental health. Through the review of critical results extracted from these sources, this paper displays the causal relationship with Covid-19's social disruptions, especially quarantine, on Vitamin D deficiency and in academic contexts. Furthermore, this paper explores the generalized risk factors associated with mental illness onset in the context of adolescent development along with an evaluation of current trends in mental health research.

Keywords: Mental Health Epidemiology, mental health in adolescents, COVID-19 pandemic, quarantine, Vitamin D, sunlight exposure, absenteeisms, rolling school closures, staff shortages, lost instructional time, test score drops, global education crisis, Quality of Life (QOL), research in mental health

Mental Health's Impact on Quality of Life

Mental disorders in adolescence have been shown to lead to long-term mental adversaries in adulthood. Yet, as a public health sector, mental health has lacked research and funding, due to current limitations in obtaining trustworthy reports and information when offering patients a prognosis for their mental health. Due to the Covid-19 pandemic, uncommon disorders such as depersonalization became more prevalent. Furthermore, various data suggest that vitamin D supplementation is crucial in individuals who experience long periods of indoor activities and low sunshine exposure. Homeostatic, trophic, and immunomodulatory effects of Vitamin D may effectively combat clinical depression. Social isolation and lockdown measures caused a reduction in the time spent outdoors and possibly less exposure to sunlight necessary to maintain vitamin D concentrations. Thus adolescents and young adults in the academic field, populations already subjected to consistent, studied mental health effects, are now facing potential implications of mental illness onset as they develop into adulthood due to the pandemic.

This paper will examine the relationship between Vitamin D deficiency and an increased risk of mental illness onset, and help address the gap in understanding the role of essential nutrients in mental health. It will also investigate the impact of academic and workplace settings on mental health, with a focus on substance use, academic stress, and reluctance to seek help, addressing a gap in the understanding of how these factors affect mental health in the USA following Covid-19, particularly in higher education. Specifically, this paper seeks to address the question: For adolescents in academic settings, how has factors stemming from the Covid-19 pandemic, including Vitamin D deficiency and social isolation, affected mental health, what are the resultant long-term implications in adulthood, and will increasing investment into research and interventions be effective in the context of adolescent development?

This paper is divided into sections based on the following key facets of Covid-19's effect on mental health epidemiology, aspects of Covid-19's lockdown that introduces downstream consequences of Vitamin D deficiency and depression prevalence, the connections between mental health disorder onset and adolescent development, and finally comment on the current clinical and biomedical research trends in mental health. Data was obtained from controlled trials and other primary sources to conduct a rigorous data analysis. There is abundant use of case studies and cross-sectional studies involved in the analysis, which results in a discussion and conclusion that aims to provide a comprehensive overview of the current state of mental health research and shed light on the various factors that contribute to mental health outcomes in the context of Covid-19.

Method

This study examined medical journals and papers from databases such as Google Scholar and PubMed, with a review of papers covering adolescent mental health in situations such as academic settings and regarding Covid-19 pandemic. The keywords used to determine papers of interest included "mental health epidemiology", "adolescent mental health", "mental health during COVID-19", "vitamin D deficiency", and "implications of mental health." The main criteria in selecting data was through student and adolescent populations (under the age of 19), selective sample sizes through surveys and permission, and assessment of statistical analysis tests to examine the relevance of data in relation to mental health in adolescents. Papers that make use of longitudinal studies, cross-sectional studies, and data extraction from online surveys, can be used to further delve into the issue of mental health decline due to COVID lockdown. The studies used Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines as well as the Newcastle–Ottawa Scale (NOS) for study

appraisal. To assure quality of online services and assess depressive and anxiety symptoms, a study makes use of the Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder (GAD-7), as well as other studies conducting the Youth Self Report (YSR) and changes in health-related quality of life (HRQoL) and mental health in children and adolescents. With a combined overview of adolescents from various parts of the world, multiple methods of data collection, and input from parental figures, the external effects of situations such as the COVID-19 pandemic, academic settings, and lack of resources influence adolescent mental health. The papers were also written in English and results were subject to multiple runs of screening. In total, 31 papers were selected to cover all topics discussed in this research paper.

COVID-19's Effect on Mental Health

Background

The COVID-19 pandemic has resulted in unprecedented global lockdowns, with schools, businesses, and public spaces closed to help contain the spread of the virus. Although necessary, these measures have had a significant impact on the mental health of individuals, especially adolescents who are at a critical developmental stage.

The pandemic has resulted in an increase in mental health treatment for adolescents in the months following the pandemic outbreak. However, "among adolescents who received any mental health services … 35% received their mental health services exclusively from school settings," and the closure of schools posed a major obstacle in receiving services (Golberstein). Early findings show that 25% of Chinese college students experienced some level of anxiety during the pandemic, and the risk of suffering from anxiety increased in those living away from their parents (Cao).The pandemic has had a significant impact on the social well-being of adolescents. The study found that adolescents experienced increased loneliness, social isolation,

and reduced social support during the pandemic (Liang). These factors were found to be

prominent predictors of depression and anxiety.This impact on student populations is a concern

for education institutions around the globe.

Overall, the COVID-19 pandemic has had a significant impact on the mental health of

adolescents, with extended periods of lockdown and social distancing measures contributing to

increased anxiety and depression. These findings highlight the need for increased mental health

support for adolescents during the pandemic and beyond. However, due to the recency of

COVID19, there is a lack of supporting evidence for the factors that play a role in the declining

mental health in adolescents.

Vitamin D is a naturally occurring group of fat-soluble secosteroids responsible for

increasing intestinal absorption of calcium, magnesium, phosphate, and other biological

processes. Specifically, in humans, Vitamin D3 is produced through the body's contact with the

UV light of the sun, or more commonly known as sunlight. Although the exact biochemical

pathway of Vitamin D's effect on depression is unknown, numerous observational studies

illustrate how Vitamin D levels inversely correlate to a higher and more significant risk of

depression in individuals. Taking this relationship into account, the study intends to examine the

general decline in mental health among populations affected by the Covid-19 pandemic under the

context of Vitamin D deficiency. During the Covid-19 pandemic, many populations underwent

the lockdown process in which individuals were barred from going outside and quarantined in

safe lockdown-designated areas such as their houses, With sunlight exposure being the most

significant method of an individual's body manufacturing Vitamin D, the Covid-19 lockdown,

which generally prevented individuals from getting abundant sunlight, may correlate to a lower

Vitamin D level in the population and thus increase the risk of depression among the population:

potentially providing an explanation for the trend of poor mental health in the population during and following the Covid-19 pandemic.

Results

In the study "vitamin D deficiency and depression in adults: systematic review and meta-analysis," researchers analyzed 9 cross-sectional studies to determine if there was an association between vitamin D levels and depression. Furthermore, they analyzed 3 cohort studies to determine whether vitamin D levels correlated to the development of depression. The summary of the results of the meta-analysis is shown in figure 1A. The meta-analysis of the cross-sectional studies generated an odds ratio (OR) of 1.31 with a 95% confidence interval (CI) of 1.00 to 1.71 and a heterogeneity p-value of 0.03. Since the odd ratio is statistically non-significant, the cross-sectional studies indicate a non-significant yet positive correlation between lower vitamin D levels and the odds of depression. The meta-analysis of the cohort studies generated a hazard risk (HR) of 2.21 with a 95% CI of 1.40 to 3.49 and a heterogeneity p-value of 0.28. The cohort studies show a statistically significant increased risk of depression with low vitamin D levels, albeit with non-significant heterogeneity.

The article "Vitamin D, Depressive Symptoms, and Covid-19 Pandemic," describes the biological synthesis and pathway of vitamin D3, as shown in figure 2. The article states that the vitamin D3 biological pathway " influence[s] several aspects of serotonin metabolism … and indirectly may regulate the synthesis of melatonin that improve the circadian rhythm" (Ceolin). The editorial, "COVID-19 pandemic: Impacts of social lockdown on nutritional health and beyond," takes vitamin D synthesis under the context of Covid-19 conditions, stating how "indoor sunlight exposure during the COVID-19 pandemic lockdown may not be beneficial because UVB rays are unable to penetrate through glass to stimulate dermal Vitamin D

synthesis" and expresses concern that "COVID-19-related lockdown has had an enormous impact on endogenous Vitamin D production" (Abukabda).

Furthermore, the article also details the deteriorating mental health conditions during the COVID-19 pandemic, as "the prevalence of depressive symptoms ranged from 14.6 to 48.3% across all populations (China, Spain, Italy, Iran, the United States, Turkey, Nepal, and Denmark). In the United States, the prevalence of symptoms associated with depression increased more than threefold during the COVID-19 pandemic compared to the times before the viral outbreak (8.5% before to 27.8% during COVID-19)" (Ceolin).

The article "How Vitamin D Levels of Children Changed During COVID-19 Pandemic: A Comparison of Pre-pandemic and Pandemic Periods" shows the change in vitamin D levels in adolescents before and during the COVID-19 pandemic. The article's tables, shown in figures 3A and 3B, display the difference in vitamin D levels through the % of 25-hydroxycholecalciferol or 25(OH)D among adolescents of different age groups. The data shows that in adolescents from age 6 to 12, the levels of 25(OH)D were significantly lower in the pandemic period than in the pre-pandemic period (p-value of 0.026), with the median 25(OH)D ng/ml for the pre-pandemic children being 16.50 with an interquartile range (IQR) of 10.5 compared to the post-pandemic children's median of 15.90 and an IQR of 11.3 (Beyazgül). The data also shows a similar relationship for adolescents aged 12 to 18, with the 25(OH)D ng/ml being 13.3 with an IQR of 10.2 pre-pandemic and 11.2 with an IQR of 9.7 post-pandemic, resulting in a statistically significant decrease in 25(OH)D levels (p-value = 0.003) from pre-pandemic to during the pandemic conditions (Beyazgül).

	Number of studies	Participants n	Vitamin D categories	Pooled OR or HR (95% CI)	I^2, %
Cross-sectional studies					
All studies	9	22318	Lowest v. highest	OR = 1.31 (1.00 to 1.71)	5 (P = 0.03)
Older adults	4	3492	Lowest v. highest	OR = 1.54 (1.00 to 2.40)	49 (P = 0.12)
Cohort studies					
	3	8815	Lowest v. highest	HR = 2.21 (1.40 to 3.49)	21 (P = 0.28)
	3	8815	Change in HR depression per 20 nmol/l change in vitamin D	β − 0.19 (− 0.41 to 004)	100 (P < 0.00001)
	3	8815	Vitamin D cut-off points of 50 nmol/l and 37.5 nmol/l (May et al)	HR = 1.04 (0.59 to 1.86)	98 (P < 0.00001)
	3	8815	Vitamin D cut-off points of 50 nmol/l and 75 nmol/l (May et al)	HR = 1.31 (0.97 to 1.77)	91 (P < 0.0001)

Fig. 1) Summary of results from the meta-analysis of cross-sectional and cohort studies of the relationship between vitamin D and depression (Anglin).
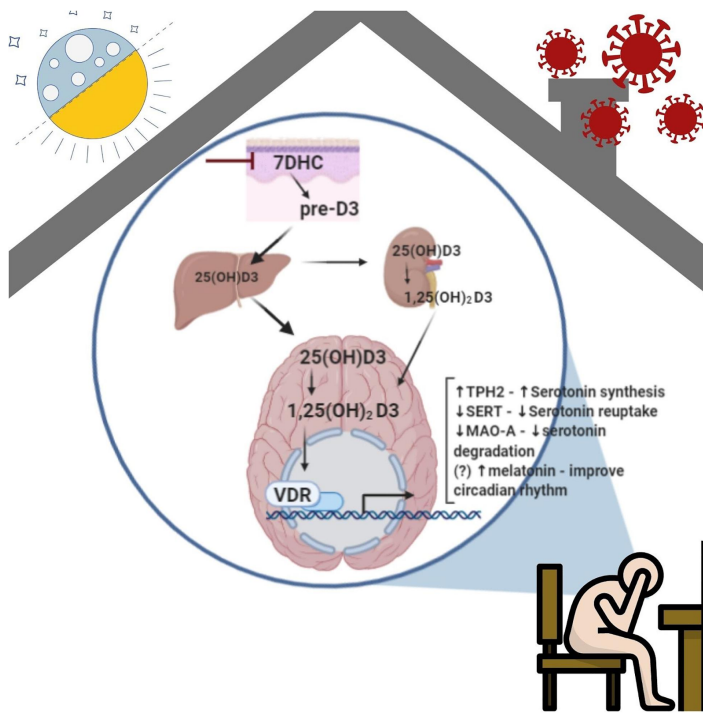
Fig. 2) Abstract of endogenous vitamin D3 synthesis and the components and effects of vitamin D3's biological pathway of vitamin D3 (Ceolin).

Table 3. Vitamin D levels according to gender in different age groups during pre-pandemic and pandemic periods

	Pre-pandemic			Pandemic		
	Girls	Boys	p	Girls	Boys	p
1-6 years, n (%)	440 (53)	395 (47)		267 (47.5)	294 (52.5)	
25(OH)D ng/mL*	18.9 (12.3)	20.5 (13.4)	0.13	21.1 (14.6)	21.7 (13.9)	0.07
6-12 years, n (%)	313 (54)	265 (46)		179 (52)	160 (48)	
25(OH)D ng/mL*	15.7 (9.4)	17.4 (11.2)	0.013	15.2 (11.6)	16.5 (10)	0.03
12-18 years, n (%)	300 (66)	151 (34)		170 (63)	99 (37)	
25(OH)D ng/mL*	13.9 (10.6)	15.3 (9.6)	0.001	10.1 (8.9)	13.9 (10.6)	0.001
Total, n (%)	1008 (54)	856 (46)		616 (53)	553 (47)	
25(OH)D ng/mL**	16.1 (11.5)	18.5 (13.2)	0.001	15.8 (14.1)	17.8 (12.8)	0.001

*Median (IQR), **mean ± SD.
SD: standard deviation, IQR: interquartile range

Fig. 3A) Table of vitamin D levels according to gender and grouped by age during pre-pandemic and pandemic periods. The statistical significance of the differences in vitamin D levels is shown under the 'p' column of the table (Beyazgül).

Table 4. 25(OH)D levels of the children between groups according to age groups

	Pre-pandemic	Pandemic	p
1-6 years (n)	835	561	0.97
25(OH)D ng/mL*	19.80 (13.2)	21.60 (14.3)	
6-12 years (n)	578	339	0.026
25(OH)D ng/mL*	16.50 (10.50)	15.90 (11.3)	
12-18 years (n)	451	269	0.003
25(OH)D ng/mL*	13.30 (10.2)	11.20 (9.7)	

*Median (IQR).
IQR: interquartile range

Fig. 3B) Table of 25-hydroxycholecalciferol [25(OH)D] levels grouped by age during pre-pandemic and pandemic periods. The statistical significance of the differences in vitamin D levels is shown under the 'p' column of the table (Beyazgül).

A nationwide longitudinal survey conducted during the pandemic (May/June 2020 and December 2020/January 2021) aimed to mark changes in health-related quality of life (HRQoL) and mental health in children and adolescents. The methods of Mixed model panel regression analyses were practiced to further examine longitudinal changes in mental health. Of the 1923 children and adolescents aged 7 to 17 years, there was an average doubling of clinically elevated anxiety (21%) and depression (25%) symptoms. The study further reports lower levels of HRQoL of children and adolescents comparing data from a population-based study gathered before the pandemic with data of another sample gathered during the pandemic. A systematic review of 63 studies compiled from MEDLINE, PsycInfo, and Web of Science for articles

published between January 1, 1946, and March 29, 2020 that included predominantly children/adolescents (mean age <21 years) showed that the duration of peer loneliness rather than intensity was associated with depression 8 years later (ie, from age 5 to age 13 years)[4]. These studies exclusively reported primary research and were double-screened and double extracted for quality assurance purposes. The data was mainly based in the United States, China, Europe, and Australia. Of the 63 studies, 43 were cross-sectional, 6 were longitudinal, and 12 reported both cross-sectional and longitudinal observations. The usage of multi-informant approaches, including self-report and parental and/or teacher report to assess mental health outcomes further assures results that are reliable. The findings of the review indicated that over one-third of adolescents report high levels of loneliness. Another systemic review used data extraction and had independent researchers conduct results synthesis with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.For study appraisal, the Newcastle–Ottawa Scale (NOS) was used. The subject population of the research were children and adolescents aged under 19 years who were exposed to COVID-19 lockdown[5]. Of the 61 articles with 54,999 children and adolescents, young people with NDD (28%), specifically ADHD, showed signs of mental distress through lockdown, in comparison to neurotypical controls (9%). Additionally, findings showed that in a lockdown that lasted three months, children exhibited, as reported by their parents/teachers, a 10% increase in emotional symptoms, a 20% increase in hyperactivity/ inattention, and a 35% increase in conduct problems. A cross-sectional study among Chinese students 12–18 years of age during the COVID-19 epidemic period consisting of 8079 participants was conducted via an online survey to assess depressive and anxiety symptoms with the Patient Health Questionnaire (PHQ-9) and the Generalized Anxiety Disorder (GAD-7)[6]. The results showed a prevalence of comorbid

depressive and anxiety symptoms was 31.3% among all the participants while the prominence of

the aforementioned symptoms in middle and high school students of China was 43.7% and

37.4%.

Discussion

The article "Vitamin D, Depressive Symptoms, and Covid-19 Pandemic" highlights the

surge in "the prevalence of depressive symptoms" in various populations during the pandemic,

with "the prevalence of symptoms associated with depression increased more than threefold

during the COVID-19 pandemic compared to before the viral outbreak" (Ceolin). Coincidently,

the article "COVID-19 pandemic: Impacts of social lockdown on nutritional health and beyond"

expresses concern about how the lockdowns enforced due to COVID-19 may have a detrimental

effect on endogenous vitamin D production due to indoor sunlight exposure, which would be the

expected source of sunlight for individuals prevented from leaving their homes, being unable to

stimulate dermal vitamin D synthesis as UVB rays are unable to penetrate through glass

(Abukabda). This relationship between the decreasing trend of mental health and the potential

vitamin D deficiency caused by lockdowns can be potentially explained by the relationship

between vitamin D deficiency and depression as the study, "vitamin D deficiency and depression

in adults: systematic review and meta-analysis," shows a statistically significant increased risk of

depression with low vitamin D levels from the meta-analysis of the three cohort studies. To

further support this notion, the biological pathway of vitamin D illustrated in "Vitamin D,

Depressive Symptoms, and Covid-19 Pandemic," shows that vitamin D3 is necessary for

multiple aspects of serotonin metabolism and could also potentially regulate melatonin synthesis.

Since both low serotonin levels and poor circadian rhythm can influence individuals to feel

depressive and negative mental health symptoms, it could potentially establish that a lower

vitamin D level could result in lower serotonin and melatonin levels, thus consequently worsening the mental health of the individual.

Taking this information into the context of adolescent mental health in the pandemic, the article "How Vitamin D Levels of Children Changed During COVID-19 Pandemic: A Comparison of Pre-pandemic and Pandemic Periods" shows a significant decrease in vitamin D levels among adolescents aged 6 to 18 during the pandemic period compared to the pre-pandemic period. Therefore, this may indicate a potential relationship between vitamin D deficiency and the observed negative trend in adolescent mental health during the COVID-19 lockdown due to the decreased vitamin D levels in school-aged adolescents (6 - 18 years old). However, it is important to note that more research is needed to investigate this relationship further to establish a more conclusive and definitive pattern in the relationship between COVID-19 enforced lockdowns, vitamin D deficiency, and adolescent mental health.

Mental Health in Academic Settings

Background

Adolescence – the stage in one's life that is deeply characterized by growth and development in all aspects of life. With the occurrence of the COVID-19 pandemic, millions of adolescents all over the world have been greatly affected, especially in terms of academic success. From staff shortages [1], lost instructional time [4], to test score drops [5], the pandemic has caused significant effects on learning amongst students worldwide.

Despite these challenges, there is minimal research about how COVID-19's effects on mental health have placed an effect on individuals' academic life. Through statements such as "44% of tested third graders in North Carolina public schools reached the proficiency benchmark in mathematics, compared with 65% in spring 2019," [6] past findings prove that there was a

decline in learning; however, there are no mentionings about how mental health has a significant factor to this. Compared to the year of 2019, in 2020, reported suicide attempts among adolescents increased by 31% [8]. Because the COVID-19 pandemic has led to a sharp decline in mental health, more recent findings must be analyzed in order to understand the long-term effects that the pandemic has caused on students' education from elementary school to college students.

Through this research paper, there will be further analysis of how students' learning was impacted due to a decline in mental health caused by the COVID-19 pandemic, alongside the potential methods towards resolving these issues.

Results

The Global Education Crisis

Due to the negative effects that the COVID-19 pandemic had on adolescents' mental health, the global education crisis exponentially worsened as a result. As COVID-19 affected school closures and economic fluctuations, the report produced by UNESCO, UNICEF, and the World Bank reflects that approximately $17 trillion, or about 14 percent of the global GDP, has been lost [9]. Student learning has been impacted substantially – before the pandemic, in low- and middle-income countries, at least 50 percent of children were incapable of literacy by age 10; however, with the pandemic, this could increase to 70 percent [9].
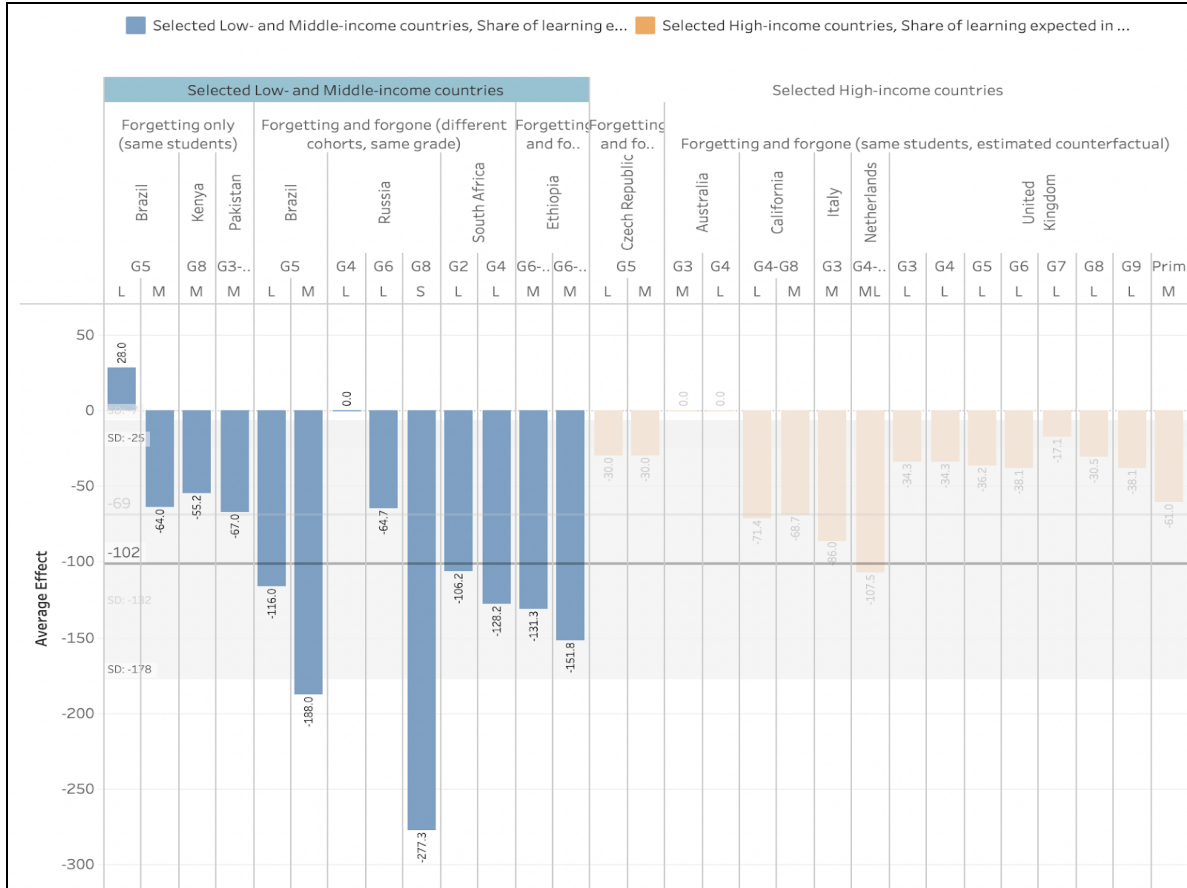
Fig. 1) Average learning loss from different countries standardized by the length of the school closure (World Bank).

Whereas the average learning loss standardized by the length of the school closure was nearly 100% in low- and middle-income countries (with a standard deviation of 74%), that of high-income countries was 43% (with a standard deviation of 30%) [9].
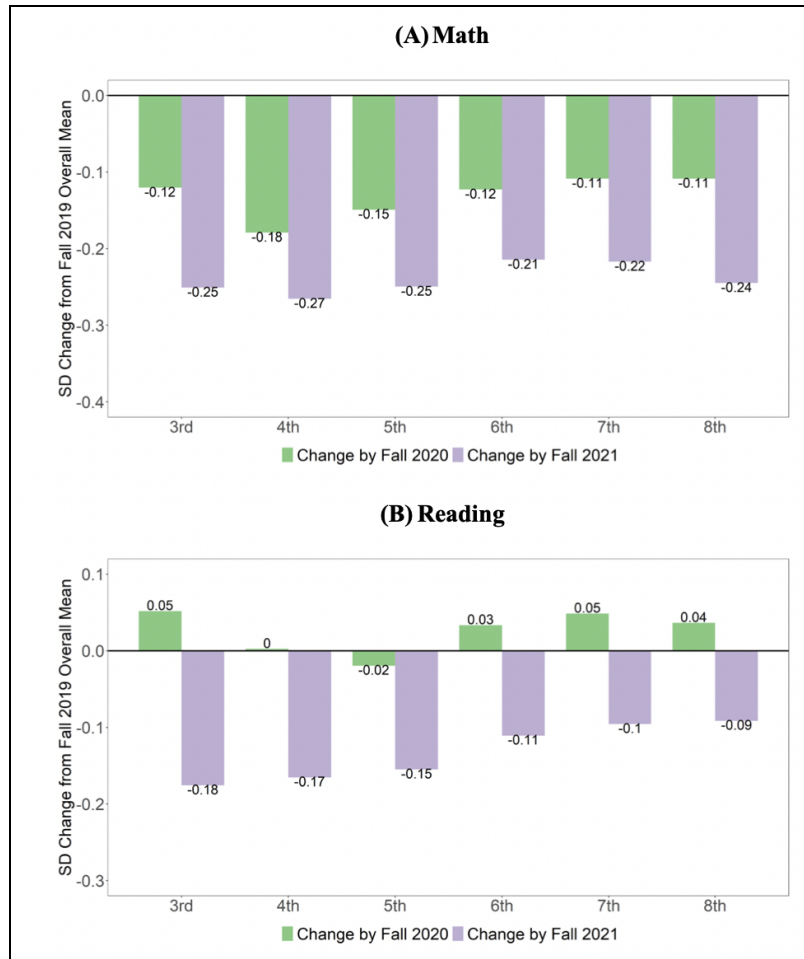
Fig. 2) Trends in MAP Growth test scores in Fall 2020 and Fall 2021 (relative to same-grade peers in fall 2019) (Brown University).

Accordingly to a study published by Brown University, when observing changes in math and reading achievement for the first two years of the pandemic amongst 5.4 million U.S. students in grades 3-8, the math test scores were an average of .20-27 standard deviations lower than before and the reading test scores were .09-.18 standard deviations lower [5].
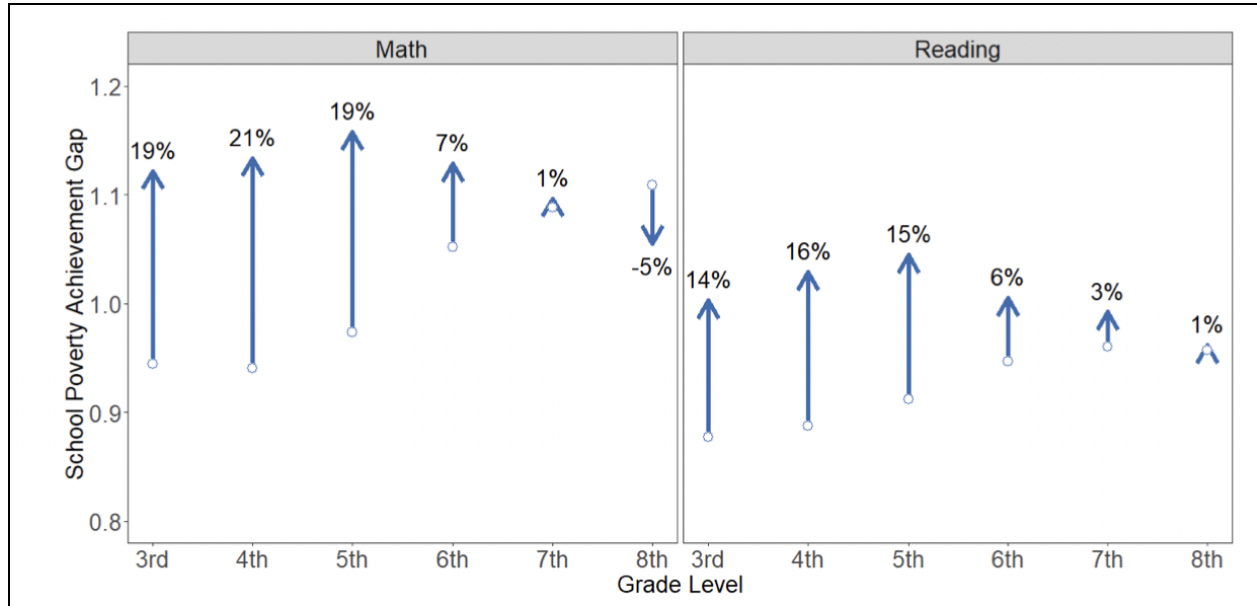
Fig. 3) Changes in achievement gaps between low- and high-poverty schools between Fall 2019 and Fall 2021 by grade and subject (Brown University).

There even became greater gaps in achievement between low-poverty and high-poverty elementary schools by .10-.20 standard deviations [5].

Implications of School Context During COVID-19 Pandemic on Mental Health

Because of the COVID-19 pandemic, adolescents were globally affected by the differences in schooling and social opportunities. Conducted by a peer-reviewed open access mega journal called PLOS One, data from 1256 United States adolescents ranging from the ages of 14 to 16 has been presented in order to examine the effects of the 2020-2021 school context (in-person, hybrid, or virtual) affected their academic lives [10]. Within this study, the participants were asked about three important measures: their school context, school satisfaction and academic success, and mental health.

In order to decipher the school context of the participants, the participants were asked during a specific month on their school engagement. The response choices were: "in-person in the school building", "hybrid model where some school is in-person and some is virtual/online",

"completely virtual/online", "a different version of school", or "did not attend school at all" [10].

Participants were also interrogated on the duration of their school engagement on a 1-7 scale,

with 1 representing 'less than 2 weeks' and 7 representing 'the entire school year' [10]. It is

important to note that adolescents who responded that they engaged in the school context

through "a different version of school" were excluded from the study, causing the sample size to

be 1177 adolescents.

To compare the effects of the participants' school context with their personal school

satisfaction and academic success, four questions related to how they were feeling about school

were asked. The 1-5 Likert-like scales were used to ask the questions about their reflections on

school satisfaction: "How do you feel about school right now?" ($M = 2.78$, $SD = 1.03$), "How

often do you feel that the school work you are assigned is meaningful and important?" ($M =$

2.78, $SD = .94$), "How interesting are most of your classes to you right now?" ($M = 2.43$, $SD =$

$.98$), and "How satisfied are you with your school experience right now?" ($M = 3.83$, $SD = 1.43$)

[10]. Generally, if the participant were to answer with the number one, then it connotes the most

negative response; on the other hand, an answer with the number five would connote the most

positive response. As for determining academic success, participants were asked to report, using

the 1-7 Likert-like scale, their grades from last school year (2019-2020) and their grades from the

current school year (2020-2021). In this case, the number one represented grades of mostly D's

or F's, whereas seven represented grades of mostly A's. The grade difference variable was

calculated by subtracting the current year's grades from the previous year's grades, showing the

grades of the previous year to be higher (*Mdifference* $= .53$, $SD = 1.78$) [10].

	School Context		
	In-Person	**Hybrid**	**Virtual**
School Satisfaction & Success			
Feelings about school	2.96_b	2.84_b	2.41_a
Meaningfulness of schoolwork	2.85_b	2.71_{ab}	2.54_a
Coursework interest	2.61_b	2.37_{ab}	2.20_a
School satisfaction	3.13_b	2.90_b	2.48_a
Drop in Grades	$.24_a$	$.41_a$	1.23_b
Social Connection & Inclusion			
Satisfaction with peer connections	2.77_b	2.58_{ab}	2.31_a
Sense of inclusion in a social group	2.83_b	2.54_{ab}	2.49_a

Fig. 4) School satisfaction and school connection by school context (PLOS One).

With mental health being an important effect from the adolescents' social context, this was also measured in the study. Eight items were used to measure the participants' loneliness ($M = 2.94$, $SD = .80$, $\alpha = .83$), five items were used to measure their social anxiety ($M = 3.28$, $SD = .85$, $\alpha = .68$), eight of the nine items from the Patient Health Questionnaire-9 were used to measure depression ($M = 2.39$, $SD = .81$, $\alpha = .88$), and eight items from the Patient-Reported Outcomes Measurement Information System Short Form for Anxiety (PROMIS-SF) were used to measure general anxiety ($M = 3.00$, $SD = 1.01$, $\alpha = .92$). Using the 1-5 Likert-like scales for the participants' responses, the number one represents '*never*,' while the number five represents '*always*.'

	School Context		
	In-Person	**Hybrid**	**Virtual**
Loneliness	2.89_a	2.94_a	3.10_a
Social anxiety	3.25_a	3.27_a	3.39_a
Depression	2.25_a	2.43_{ab}	2.63_b
Anxiety	2.93_a	3.13_{ab}	3.24_b

Fig. 5) Mental Health by School Context (PLOS One).

Discussion

Because of the COVID-19 pandemic, there have been many inevitable obstacles affecting adolescents all around the world, particularly with their mental health. Through factors such as severe staff shortages, absenteeism and quarantines, rolling school closures, and lost instructional time, there is data that supports that the pandemic has affected the education crisis in a more serious manner than prior belief [1, 2, 3, 4]. However, there has yet to be a sufficient amount of data that supports the relationship between the decline in mental health and the decline in student learning, despite the damage that is being felt by both the kids and the schools [7, 8, 10]. This may be due to the lack of self-reported data, as well as most countries having yet to measure learning losses.

From lack of funding to the differences in the quality of education that adolescents from different locations and socioeconomic backgrounds received, the education crisis has always been a significant issue, even prior to the pandemic. The COVID-19 pandemic, unfortunately, heightened this crisis by provoking more issues, reflecting significant changes in academic gaps between different groups of individuals [5, 6]. Because people from low-income backgrounds were unavoidably more prone to encountering financial issues than people from higher-income backgrounds, they were more negatively affected, as demonstrated by the data [5, 9].

Aside from socioeconomic differences, the decline in mental health amongst adolescents is one of the prominent reasons why the education crisis has become more of an issue. Considering that students who attended school virtually generally had lower opinions about school in comparison to those who attended in-person, this seemed to affect their outlooks on the significance of schoolwork [10]. With four variables of mental health (loneliness, anxiety, social anxiety, and depression) being evaluated to determine the effect of school context, there was a

general consensus that individuals who attended school virtually experienced worse mental health in comparison to those who attended school in-person [10].

With the results of these studies, there is an emphasized need for understanding how the decline in mental health caused by the COVID-19 pandemic affects adolescents and their education.

Long-term Implications of Mental Health

Background

Mental disorders in adolescence have been shown to lead to long-term mental adversaries in adulthood. Self-reported mental health statistics are cited from participants ages 11 and older selected from five municipalities in the North Netherlands and exams who took the Youth Self Report (YSR) and the Adult Self Report (ASR) [7, 9]. Currently, mental disorders show a clear disconnect between biological diagnosis and statistics, so exams such as the YSR have been proven to be validated and reliable sources of information when surveying adolescents and individuals.

A separate study focused on Chinese adolescents, uncovering the main a number of variables influencing mental health such as higher grades, physical disease, chronic constipation, alcohol consumption, engagement in sexual behavior, residence on campus, and living in nonurban areas or with single-parent families had a clear connection to students have increased chances of mental disorders [2]. Particularly, in academic settings, such as a college campus, academic stress proved to be the most frequent culprit for stress, with 58.9% of respondents citing that this caused them the most difficulty for their mental health [2].

This research paper will further investigate the deficiencies in research covering mental health, as well as the developed methods of reporting mental disorders and effective techniques for solving current mental health problems.

The effectiveness of research covering mental health, as well as the developed methods of reporting mental disorders and effective techniques for solving current mental health problems are unknown to be certainly beneficial.

Results

Mental disorders and mental health issues in adolescence have proved to have long-term implications into adulthood based upon self-reported data from qualified exams such as the Youth Self Report (YSR), which is a self-reported exam that assesses behavioral problems for individuals between the ages 11-18 years old alongside two broad scales: Internalizing and Externalizing. The exam is often used alongside the Adult Self Report (ASR) for individuals at the age of 22 to predict the association between childhood mental health disorders and Quality of Life (QOL) when an adult [9]. Self-reports examining QOL often focus on different aspects of youth or adult life, including physical and mental well-being, social roles, workplace roles, and comfort, as well as other aspects that individuals may consider relevant when reporting their sense of QOL [7]. The use of the Adult Behavior Checklist can help predict the trajectory of mental health disorders in childhood on functioning in adulthood, as well as supplement QOL. Originally, when researching the implications of mental disorders on the general population, it became a recurring theme that mental health has been a consistently neglected public health sector, illustrating that there is an apparent gap in obtaining quantitative, reliable research concerning mental health [1, 5]. It is likely that mental health in medical research is often

neglected simply because it is so based upon self-reported data and patients' ability to even report that data.

Although there is widespread knowledge that poor mental health has proved to be a continuously problematic burden to world populations, an absence of precise biological data has led to skepticism about the prevalence of data and how accurate it may be for the public health sector to take action [5]. Similarly, despite their burden for targetted populations, mental disorders have often been associated with chronic disabilities rather than death, though suicide and other chronic mental disabilities have been linked to death and limited QOL.

In order to close the seemingly increasing gap between mental health research and deficiency in this public health sector, physicians and researchers have to further implement, research, and work with self-reported data through the available exams and reports for patients.

Adolescent Mental Health

The TRacking Adolescents' Individual Lives Survey (TRAILS) is a prospective cohort study that took participants from five municipalities in the North of the Netherlands, with children born between October 1, 1989, and September 30, 1991. In the area, 135 primaries with 3,483 eligible children and 3,145 children (~90%) agreed to participate in the study; however, following the interviewing process with parents as well as possible participants, the cohort enrolled 2,935 eligible children [9, 10].

The Internal and External scales of the Youth Self Report (YSR) assessed mental health symptoms, with participants responding to questions on a three-point scale: 0 = not true, 1= somewhat true, 2 = very often/always true. The Internal scale covers subscales directly influencing patients' mental health, such as Anxious/Depressed, Withdrawn/Depressed, and

Somatic Complaints, while the External scale consists of outward subscales such as

Rule-Breaking Behaviour, Aggressive Behaviour, and Intrusive [9].

The study for adolescent mental health had subscales that ranged from good to excellent

across all four waves (waves 1-3 using the YSR and wave 4 using the Adult Self Report (ASR)).

Results included T1: $\alpha_{INT} = 0.87$, $\alpha_{EXT} = 0.85$; T2: $\alpha_{INT} = 0.88$, $\alpha_{EXT} = 0.85$; T3: $\alpha_{INT} = 0.89$, $\alpha_{EXT} =$

0.87; T4: $\alpha_{INT} = 0.93$, $\alpha_{EXT} = 0.89$ [9]. The purpose of the study was to identify developmental

trajectories of internalizing and externalizing mental health symptoms through adolescence, as

well as document the quality of life outcomes in young adulthood.

Implications of Mental Health into Adulthood

Research has shown that not only do physical disorders have long-term implications for

adolescents but so do mental disorders in QOL. The study examined long-term data using

now-grown adolescents from the Children in the Community Study, an investigation covering

childhood behavior and development based on random samples: 800 mothers and one randomly

sampled child from each of these 800 families from two upstate New York counties. The sample,

using the same subjects in the original 1975 study, had a high proportion of Catholics (54%) and

White residents (91%).

The psychological well-being domain of the survey was measured in three scales that

assessed expectations for the future, negative feelings, and church attendance or religious beliefs,

while the social relationships domain assessed the extent of contact and quality of relationships

with friends as well as the quality of a relationship with a partner or other close confidante [7].

Participants for the study had a mean age of 33 years with 54.8% female participants, 91.3%

White participants, 8.7% Black participants, 69.7% were married or co-inhabiting, 75.5% had a

post-high school education, and 38.0% were from urban areas [7].

Following the 17 years since the beginning of the study, adolescents with a mental disorder but no physical illness (89 participants) reported more problematic social relationships, lower psychological well-being, and more adversity in their environmental context. Yet, adolescents who reported both a physical and mental disorder were more impaired in all five QOL domains (physical health, social relationships, psychological well-being, role function, and environmental context) [7].

Discussion

In adolescence, neglected mental health adversaries in adolescence have often led to implications and struggles into adulthood when neglected. Implications often went beyond an individual's psychological well-being, but also the spheres of their lives, such as social relationships and economic well-being. Yet, despite the correlation between adolescent mental health and the long-term effects of one's well-being in the long-term, there are wide gaps in research that are slowly being closed. The last major study covering the long-term effects of mental health in adolescents started in 1975 as well as focused on a very particular population which consisted of mostly White participants in suburban homes, reflecting a lack of knowledge in other populations [7].

The lack of chemical and biological correlations to mental health have also led to an increased skepticism of self-reported data which validates the struggles of youth in their mental well-being and health. Yet, for a subject such as mental health, where biological research is limited, self-reported data is especially valuable, particularly when participants are defining their emotions through a variety of different statements, such as the TRAILs cohort in the Netherlands [9, 10].

The results of the case studies illustrate a necessity for a greater focus on mental health and its impact on individuals such as developing adolescents into their adulthood.

Current Trends in Mental Health Research

Background

Mental health, as a public health sector, has lacked research in terms of the externalities of mental health as well as the long-term implications of adolescent mental health. Yet, there are clear correlations between mental health and effects on other existing factors surrounding a person's well-being involving their economic status and physical health. For one, cost of poor mental health has been estimated to be between 3-4% of developed countries' Gross Domestic Product (GDP), as mental disorders in childhood have been shown to have a correlation to problematic adulthood such as longstanding social and economic consequences in adulthood, including increased contact with the criminal justice system, reduced levels of employment and often lower salaries when employed, and personal relationship difficulties [6, 7].

Despite the ongoing yet ever-slimming doubt and skepticism about the legitimacy of self-reported data about mental health, there are promising results in investing more in mental health resources and funding in the public health sector – for both the population and the economy. There is an apparent burden on patients struggling with mental health to even afford treatment or care for their mental health, illnesses that can and will affect a patient's well-being as well as their physical health.

Current trends in mental research have developed to focus in terms of the long-term and external implications of patient's emotional health and well-being.

Results

Economic Burden on Patients

A 2016 update of the Global Burden of Disease Study presented that depressive disorder

and anxiety disorder ranked in the top 10 conditions accounting for disability, as well as seven

other mental illnesses considered amongst the 30 most burdensome conditions [1, 15].

Not only does the treatment place a heavy economic burden on patients, but so does travel and

consultations to receive treatment, a long list of additional costs in terms of time and money [14].

A study in the Netherlands elected participants between the ages of 18-65 from 19 different

general practices, with eligible participants needing to present sub-threshold depression, meaning

that patients expressed having one core symptom as well as one, two, or three current depressive

symptoms. The study divided the elected pool of participants into two groups: one group

receives minimal contact psychotherapy alongside usual care (n-107) or the usual care without

minimal contact psychotherapy. Following the trial, 75 participants from the clinical trial and 87

participants without the adjunctive minimal contact psychotherapy responded to an economic

questionnaire. The minimal contact psychotherapy utilized a self-help book titled *Coping with*

Depression as well as guided therapy through six short telephone calls with a prevention worker.

The economic cost of the intervention also took into account other external effects of mental

health, such as other medical costs, antidepressants, interventions, and costs of work loss [14].

Following 12 months of the trial period, the incidence rate of depressive disorder was 11.9% in

the adjunctive psychotherapy group, while an 18.3% incidence rate in the group that received

only usual care. Over the one year, the adjunctive psychotherapy group averaged costs of

intervention to be about $450.77 (€423); however, these additional costs were partially

compensated by savings elsewhere in the medical sector [14]. Furthermore, out-of-pocket

medical costs for the intervention sector were \$469.95 (€441) while the usual care sector had out-of-pocket medical costs of about \$540.28 (€507).

To calculate cost-effectiveness, the ratio was calculated using $(C_1-C_0)/(E_1-E_0)$, where C is the average annual per capita cost and E is the percentage of people who did not develop depression (experimental conditions subscripted 1 and control conditions subscripted 0). To calculate the cost-effectiveness of the intervention program, substituted values (6766–8614)/(88.1–81.7) yielded €288.75 (\$307.71). Through the experimental treatment, it was calculated that a cost-cut of about \$307.71 can be made when an individual does not experience depressive episodes thanks to intervention.

Outcomes of Investing in Mental Health

Apart from the economic effects of mental health intervention programs, the benefits of interventions for patients' QOL and mental health are also valuable. A study focused on the relationship between sociodemographic factors as well as psychological and social well-being among adolescents in Canada aged 12 to 17 years old. The survey explored the relationships between sex, grade, and province with autonomy, competence, and relatedness for Candian adolescents. Participants rated their well-being based on self-reported autonomy, competence, and relatedness by circling from six different statements which wrote positive affirmations. Participants reported high relatedness (81.8%), high levels of happiness (79.3%), high competence (78.4%), high autonomy (73.0%), life satisfaction (61.0%), and high self-rated mental health (75.9%) [8].

At the time of the survey, participants were asked to circle the response that best represented their feelings in the past week, responses including 1) "I feel free to express myself at home;" 2) "I feel free to express myself with my friends;" 3) "I feel I have a choice about

when and how to do my schoolwork;" 4) "I feel I have a choice about which activities to do with my friends;" 5) "I feel free to express myself at school;" and 6) "I feel like I have a choice about when and how to do my household chores" [8]. The survey examined how participants felt about their own sense of independence as well as others perceptions of them.

Then, they had to respond about their competence, again, having to choose from six options that described their feelings in the past week at the time of the survey: 1) "I feel I do things well at school;" 2) "I feel my teachers think I am good at things;" 3) "I feel I do things well at home;" 4) "I feel my parents think that I am good at things;" 5) "I feel I do things well when I am with my friends;" and 6) "I feel my friends think I am good at things" [8].

Lastly, participants responded in a survey examining their social well-being, using a relatedness scale that also included six different options in which participants were asked to circle the statement that best describes their feeling of relatedness. The six statements read as follows: 1) "My teachers like me and care about me;" 2) "I like to spend time with my parents;" 3) "My parents like me and care about me;" 4) "I like to be with my teachers;" 5) "My friends like me and care about me;" and 6) "I like to spend time with my friends" [8]. The response options for the autonomy, competence and relatedness surveys were: 1) "really false for me," 2) "sort of false for me," 3) "sort of true for me," and 4) "really true for me." The mean scores across all categories were 3) or 4) on the given scale [8].

Discussion

As a public health sector, mental health has lacked research and funding, due to current limitations in obtaining trustworthy reports and information when offering patients a prognosis for their mental health [5]. As it stands currently, results about mental health disorders are often based upon self-reported data, rather than chemical and biological data, making researchers

skeptical of the sheer impact of mental health in developed nations. Yet, it is apparent that mental health disorders have and is becoming an increasing concern for the public health sector despite prior skepticism, as depression is the third leading contributor to the global disease burden, and in 2009, it was estimated that by 2020, an estimated 1.5 million people will die each year from suicide, while upwards of 15 to 30 million will attempt suicide at some point [12].

Even with skepticism surrounding data concerning mental health, increased funding for mental health in the public health sector has proved to have positive impacts, as in Canada, following the implementation of increased attention to mental health, respondents to the YSR have reported having 81.8% relatedness, 79.3% high happiness, 78.4% high competence, and 75.9% high self-related mental health [8].

Current research to promote the benefits of increased mental health research in the public health sector has been lacking, but studies and research filling those gaps have been proven to illustrate the necessary barriers to be broken for achieving better global mental health. The absence of cures, treatments, and preventive measures for Neurological and Substance-Use (MNS) Disorders for mental diseases such as schizophrenia, depression, and alcohol dependence as well as other mental disorders proves the limited understanding of the brain and its functionality [12]. There are not any sort of preventive measures and treatments for mental health, as well as there are limited treatment and intervention programs that are even affordable for patients struggling with their mental well-being and health.

Conclusion

From the gathered data covering a diverse array of influences on mental health, results suggest that aspects such as high-stress settings in academics and workplaces, isolation situations such as the COVID-19 pandemic, and negligence of mental health can have long-term effects on

adolescent patients and their well-being. Studies have suggested that untreated mental illnesses can lead to long-term consequences beyond patients' well-being, including their social relationships, workplace relationships, and economic status and physical health. Results have concluded that intervention programs can benefit patients in refining and improving their lives, illustrating that intervention and increased research in mental health as a public health sector can further improve patients' live and overall well-being of adolescents.

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