COVID-19 and Adolescent Depression and Suicide Risk Screening Outcomes

Stephanie L. Mayne, PhD, MHS,[a,b,c] Chloe Hannan, MS,[a,c] Molly Davis, PhD,[d,e] Jami F. Young, PhD,[c,d,f] Mary Kate Kelly, MPH,[a,c] Maura Powell, MPH,[a] George Dalembert, MD, MSHP,[a,b,c] Katie E. McPeak, MD,[a,b,c] Brian P. Jenssen, MD, MSHP,[a,b,c] Alexander G. Fiks, MD, MSCE[a,b,c]

abstract

BACKGROUND: Mental health concerns increased during the coronavirus disease 2019 pandemic, but previous studies have not examined depression screening in pediatric primary care. We aimed to describe changes in screening, depressive symptoms, and suicide risk among adolescents during the coronavirus disease 2019 pandemic.

METHODS: In a repeat cross-sectional analysis of electronic health record data from a large pediatric primary care network, we compared the percentage of primary care visits where adolescents aged 12 to 21 were screened for depression, screened positive for depressive symptoms, or screened positive for suicide risk between June and December 2019 (prepandemic) and June and December 2020 (pandemic). Changes were examined overall, by month, and by sex, race and ethnicity, insurance type, and income. Modified Poisson regression was used to calculate prevalence ratios (PRs) for the prepandemic to pandemic changes.

RESULTS: Depression screening at primary care visits declined from 77.6% to 75.8% during the pandemic period (PR: 0.98, 95% confidence interval [CI]: 0.90–1.06). The percentage of adolescents screening positive for depressive symptoms increased from 5.0% to 6.2% (PR: 1.24, 95% CI: 1.15–1.34), with greater increases among female, non-Hispanic Black, and non-Hispanic white adolescents. Positive suicide risk screens increased from 6.1% to 7.1% (PR: 1.16, 95% CI: 1.08–1.26), with a 34% relative increase in reporting recent suicidal thoughts among female adolescents (PR: 1.34, 95% CI: 1.18–1.52).

CONCLUSIONS: Results suggest that depression and suicide concerns have increased during the pandemic, especially among female adolescents. Results underscore the importance of consistent depression and suicidality screening.

Full article can be found online at www.pediatrics.org/cgi/doi/10.1542/peds.2021-051507

[a]The Possibilities Project, Children's Hospital of Philadelphia, [c]Center for Pediatric Clinical Effectiveness and PolicyLab, and [f]Department of Child and Adolescent Psychiatry and Behavioral Sciences, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania; and [b]Departments of Pediatrics and [d]Psychiatry, Perelman School of Medicine, and [e]Penn Implementation Science Center at the Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, Pennsylvania

Dr Mayne conceptualized and designed the study, supervised data analyses, drafted the initial manuscript, and reviewed and revised the manuscript; Ms Hannan and Ms Kelly collected the data, conducted the analyses, and reviewed and revised the manuscript; Dr Davis, Dr Young, Ms Powell, Dr Dalembert, Dr McPeak, Dr Jenssen, and Dr Fiks conceptualized and designed the study and critically reviewed and revised the manuscript for important intellectual content; all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DOI: https://doi.org/10.1542/peds.2021-051507

Accepted for publication Jun 07, 2021

Address correspondence to Stephanie Mayne, PhD, MHS, 2716 South St, 10-471, Children's Hospital of Philadelphia, Philadelphia PA 19146. E-mail: maynes@chop.edu

WHAT'S KNOWN ON THIS SUBJECT: Adolescent mental health concerns have increased during the coronavirus disease 2019 pandemic. Adolescents are routinely screened for depression and suicidality in pediatric primary care, but past studies have not examined changes in these outcomes during the pandemic in primary care.

WHAT THIS STUDY ADDS: Using electronic health record data from a large pediatric primary care network, we identified increases in the proportion of adolescents screening positive for depressive symptoms and suicide risk in pediatric primary care during the pandemic, especially among female adolescents.

To cite: Mayne SL, Hannan C, Davis M, et al. COVID-19 and Adolescent Depression and Suicide Risk Screening Outcomes. *Pediatrics*. 2021;148(3):e2021051507

Rates of mental health concerns among adolescents, including depression and suicidal ideation, have risen substantially in recent years.[1,2] The coronavirus disease 2019 (COVID-19) pandemic has placed numerous stresses on adolescents because of school closures, disruptions of routines, social isolation, and concerns about family illness and economic impacts.[3] Consequences of these stressors among children from racially and ethnically minoritized and low-income communities may be especially acute.[4,5] Researchers in several studies have reported high prevalence of mental health concerns among children and adolescents during the pandemic.[6–9] However, few studies to date have examined changes in depression and suicidality, as well as changes in screening for these concerns, among adolescents from before to during the pandemic.

One recent US study reported higher rates of suicidal ideation and suicide attempts among youth aged 11 to 21 years in a pediatric emergency department (ED) during the first 6 months of the COVID-19 pandemic compared with the same period a year earlier.[10] Pediatric primary care is also an important setting for routine mental health screening among adolescents. Primary care providers develop longitudinal, trusting relationships with families and may facilitate linking adolescents to needed treatments.[11,12] The American Academy of Pediatrics (AAP) and the US Preventive Services Task Force recommend universal screening for depression among adolescents,[13,14] and many pediatric primary care practices have implemented depression screening programs. Screening for depression often involves administering questions about suicide risk. Although mental health screening occurs in other settings, including schools, the transition to virtual education during the pandemic has magnified the importance of the medical setting for adolescent mental health screening.

To understand how the COVID-19 pandemic has impacted mental health among adolescents in pediatric primary care, we examined changes in the frequency of screening for depression and suicide risk, as well as the percentage of positive screens, in a large pediatric primary care network from before to during the pandemic. We also examined whether changes in these outcomes varied by sex, race and ethnicity, insurance type, and neighborhood socioeconomic status to understand patterns in the context of existing disparities.[2,15,16]

METHODS

Study Population

Our study took place in the Children's Hospital of Philadelphia (CHOP) primary care network, a large pediatric primary care network made up of 29 urban, suburban, and semirural practices in the greater Philadelphia region.[17] The Care Network provides care for nearly 300 000 patients. Using a repeated cross-sectional design, we extracted electronic health record data from all preventive visits by adolescents aged 12 to 21 (up to the 22nd birthday) who attended a primary care visit in the CHOP primary care network between June 1, 2019, and December 31, 2020. The CHOP Institutional Review Board determined this study to be exempt from review.

Outcomes

To examine changes in screening, depression, and suicide risk from before the COVID-19 pandemic to during the pandemic, we defined 2 periods: June to December 2019 (prepandemic) and June to December 2020 (pandemic). These months were chosen as comparison periods because primary care visit volume had begun to normalize in June 2020 after a steep decline in March through May 2020. We assessed 3 primary outcomes in each period (overall and by month): (1) the percentage of adolescents screened for depression and suicide risk among those attending a primary care preventive visit, (2) the percentage of adolescents screened with a positive result for depression symptoms, and (3) the percentage of adolescents screened with a positive result for suicide risk. Depression and suicide risk during the 2 weeks before screening were assessed routinely through a fully automated electronic screening system by using the Patient Health Questionnaire-Modified for Teens (PHQ-9-M), which includes 9 core items and 2 supplemental items assessing suicide risk.[11,18] CHOP implemented the PHQ-9-M for routine depression and suicide risk screening after review of available tools by a committee of screening experts. The PHQ-9-M was chosen because it is brief, nonproprietary, has been validated and used previously in large health systems,[19,20] and is recommended in clinical guidelines including the Guidelines for Adolescent Depression in Primary Care (GLAD-PC)[13] and the AAP's Bright Futures recommendations.[21] At CHOP, the PHQ-9-M is currently available in English and Spanish. PHQ-9-M scores of 11 to 27 indicate a positive result for moderate-to-severe symptoms of depression, whereas scores of 5 to 10 indicate borderline (ie, subthreshold) depressive symptoms. Suicide risk was assessed using 3 questions; an affirmative response to any of the 3 flagged the adolescent for suicide risk. The questions included the item on the

PHQ-9-M assessing thoughts of death and/or self-harm ("Thoughts that you would be better off dead, or of hurting yourself in some way?"; on a scale ranging from 0 to 3, where a score of 1 or greater was considered endorsement of risk) and 2 supplemental yes or no questions ("Has there been a time in the past month when you have had serious thoughts about ending your life?"; "Have you ever, in your whole life, tried to kill yourself or made a suicide attempt?") Because the item on thoughts of death or self-harm may identify adolescents with a wide range of suicidal ideation severity,[18] we also examined the 2 supplemental questions separately.

Demographic Variables

We examined changes in depression and suicide risk screening outcomes during the pandemic on the basis of 4 demographic variables: sex, race and ethnicity (non-Hispanic Black, non-Hispanic white, Hispanic, Asian American, other race), payer (public, commercial, self-pay or other), and neighborhood socioeconomic status (quartiles of census tract-level median household income). Sex, race and ethnicity, and payer were extracted from the electronic health record. Patient addresses were geocoded by the health system and linked to residential census tracts. Neighborhood socioeconomic status was assessed as census tract-level median household income using data from the American Communities Survey 2014–2018 5-year estimates, and was divided into quartiles for analysis.[22]

Statistical Analysis

Changes in screening, positive depression screens, and positive suicide risk screens between the prepandemic and pandemic periods were calculated overall, by month, and across subgroups on the basis of sex, race and ethnicity, insurance, and neighborhood income. We used logistic regression, followed by marginal standardization, to calculate 95% confidence intervals (CIs) around the absolute changes in each outcome. We used Poisson regression with robust variance estimates[23] to calculate prevalence ratios (PRs) to show changes in depression and suicide risk screening outcomes on a relative scale. We estimated robust standard errors accounting for the clustering of adolescents within primary care practices. To examine differences in the amount of change between demographic subgroups, we used multivariable Poisson models including the demographic variables described above, a binary indicator for time period (June–December 2020 versus June–December 2019) and interaction terms between time period and demographic variables. Statistical analyses were conducted by using Stata version 16.1 (Stata Corp, College Station, TX) and R version 3.6.1.

RESULTS

Our study sample included 91 188 well visits by 68 669 adolescents, including 43 504 in the prepandemic period and 47 684 in the pandemic period. The total number of visits was higher during the pandemic period because of a local initiative to bring adolescents in for well visits where vaccines were needed in advance of the start of the school year, and because of rescheduling of adolescents whose visits were canceled during the early months of the pandemic. Adolescents' average age was 15.2 (SD: 2.1) in the prepandemic and 15.3 (SD: 2.1) in the postpandemic period. The proportion of visits by non-Hispanic Black adolescents declined slightly during the pandemic period, as did the proportion of visits among commercially insured adolescents and those in the lowest quartile of neighborhood household income (Table 1).

Changes in Mental Health Screening Prevalence

The total number of adolescents screened for depression increased slightly, from 33 754 in the prepandemic period to 36 161 in the postpandemic period, reflecting the overall increase in visits during this period. However, the percentage of well visits at which a screen was completed declined slightly, from 77.6% to 75.8% (PR: 0.98, 95% CI: 0.90–1.06). The difference between 2019 and 2020 was most pronounced in June (PR: 0.86, 95% CI: 0.75–0.99; Fig 1A) and diminished over time. Screening rates declined among all demographic groups except non-Hispanic Black adolescents and those with noncommercial insurance (Table 2). However, adjusted PRs indicated there were minimal differences after accounting for demographic characteristics and clustering by practice (Table 2).

Changes in Positive Screens for Depressive Symptoms

Overall, the percentage of adolescents screening positive for moderate-to-severe depressive symptoms (scores of 11–27) increased from 5.0% in the prepandemic period to 6.2% in the postpandemic period. This reflects a 24% increase in the prevalence of moderate-to-severe depressive symptoms (PR: 1.24, 95% CI: 1.15–1.34). When broken down by month, there was an increase in prevalence in the pandemic period in August, October, November, and December (Fig 1B). The amount of change differed by sex (P interaction $<.001$, Table 3), with an increase among female, but not

TABLE 1 Population Characteristics at Adolescent Preventive Visits

Characteristic	Prepandemic (2019), *n* (%)	Pandemic (2020), *n* (%)
Total visits	43 504	47 684
Age, mean (SD)	15.2 (2.1)	15.3 (2.1)
Sex		
Female	21 436 (49.3)	23 715 (49.7)
Male	22 068 (50.7)	23 968 (50.3)
Race and ethnicity		
Non-Hispanic Black	10 190 (23.4)	10 294 (21.6)
Non-Hispanic white	24 578 (56.5)	26 976 (56.6)
Hispanic or Latino	2700 (6.2)	3360 (7.0)
Asian American	1883 (4.3)	2123 (4.5)
Other race	4152 (9.5)	4931(10.3)
Insurance type		
Commercial	32 566 (74.9)	35 261 (73.9)
Medical assistance	10 334 (23.8)	11 834 (24.8)
Self-pay or other	603 (1.4)	588 (1.2)
Neighborhood median income (quartiles)		
$11 497–$59 870	11 260 (25.9)	11 553 (24.2)
$59 871–$86 620	10 707 (24.6)	12 092 (25.4)
$86 621–$111 591	10 870 (25.0)	12 076 (25.3)
$111 591–$236 518	10 653 (24.5)	11 948 (25.0)

male, adolescents (PR: 1.32 [1.24–1.42] vs 1.02 [0.89–1.67]). By race and ethnicity, changes were largest among non-Hispanic white (PR: 1.29, 95% CI: 1.18–1.42), non-Hispanic Black (PR: 1.24, 95% CI: 1.11–1.39), and other race adolescents (PR: 1.24, 95% CI: 1.00–1.54, *P* interaction = .02). Positive depression screens increased similarly among commercially and publicly insured adolescents and among adolescents of all neighborhood incomes (Table 3). The percentage of adolescents screening positive for borderline depressive symptoms increased from 15.6% to 16.7% (PR: 1.07, 95% CI: 1.02–1.13). By month, there was an increase in prevalence during the pandemic period in July and December (Fig 1C). Patterns differed by insurance type, with the largest increase among self-pay or other insurance (PR: 1.41, 95% CI: 1.06–1.87; Table 3).

Changes in Positive Screens for Suicide Risk

The percentage of adolescents screening positive on any of the 3 suicide risk items increased from 6.1% to 7.1%, reflecting a 16% relative increase in prevalence (PR: 1.16, 95% CI: 1.08–1.26). The pandemic period had an increase in positive suicide risk screens during October, November, and December (Fig 1D). The increase in suicide risk was greater among female compared with male adolescents (PR: 1.18 [1.11–1.26] vs 1.09 [0.99–1.19], *P* interaction = .07) but did not differ significantly according to other sociodemographic characteristics (Table 4). For the two supplemental suicide questions, we similarly found small absolute increases from the prepandemic to pandemic periods but larger relative changes. The percentage endorsing recent suicidal thoughts increased from 1.8% to 2.2% overall (PR: 1.22, 95% CI: 1.10–1.37), with an increase relative to the prepandemic period during October and November (Fig 1E). There was a greater increase among female compared with male adolescents (PR: 1.34 [1.18–1.52] vs 1.00 [0.86–1.17], *P* interaction < .001). The relative increase in recent suicidal thoughts was higher among non-Hispanic white adolescents (PR: 1.45, 95% CI: 1.27–1.65) compared with other race and ethnicity groups (Table 4, *P* interaction = .16). Increases were similar between commercially and publicly insured adolescents, whereas the prevalence of recent suicidal thoughts decreased among adolescents with self-pay or other insurance. The percentage reporting a lifetime suicide attempt increased from 3.1% to 3.5% (PR: 1.13, 95% CI: 1.01–1.25) and did not differ substantially by month or by demographic characteristics (Fig 1F, Table 4).

DISCUSSION

In this analysis of depression and suicide risk screening among adolescents in pediatric primary care, we found that the percentage of adolescents screened initially declined but quickly returned to prepandemic levels. The percentage of positive depression screens increased in the pandemic period, particularly among female, non-Hispanic Black, and non-Hispanic white adolescents. Suicide risk–positive screens also increased, especially among female adolescents. By month, increases in positive screens relative to the

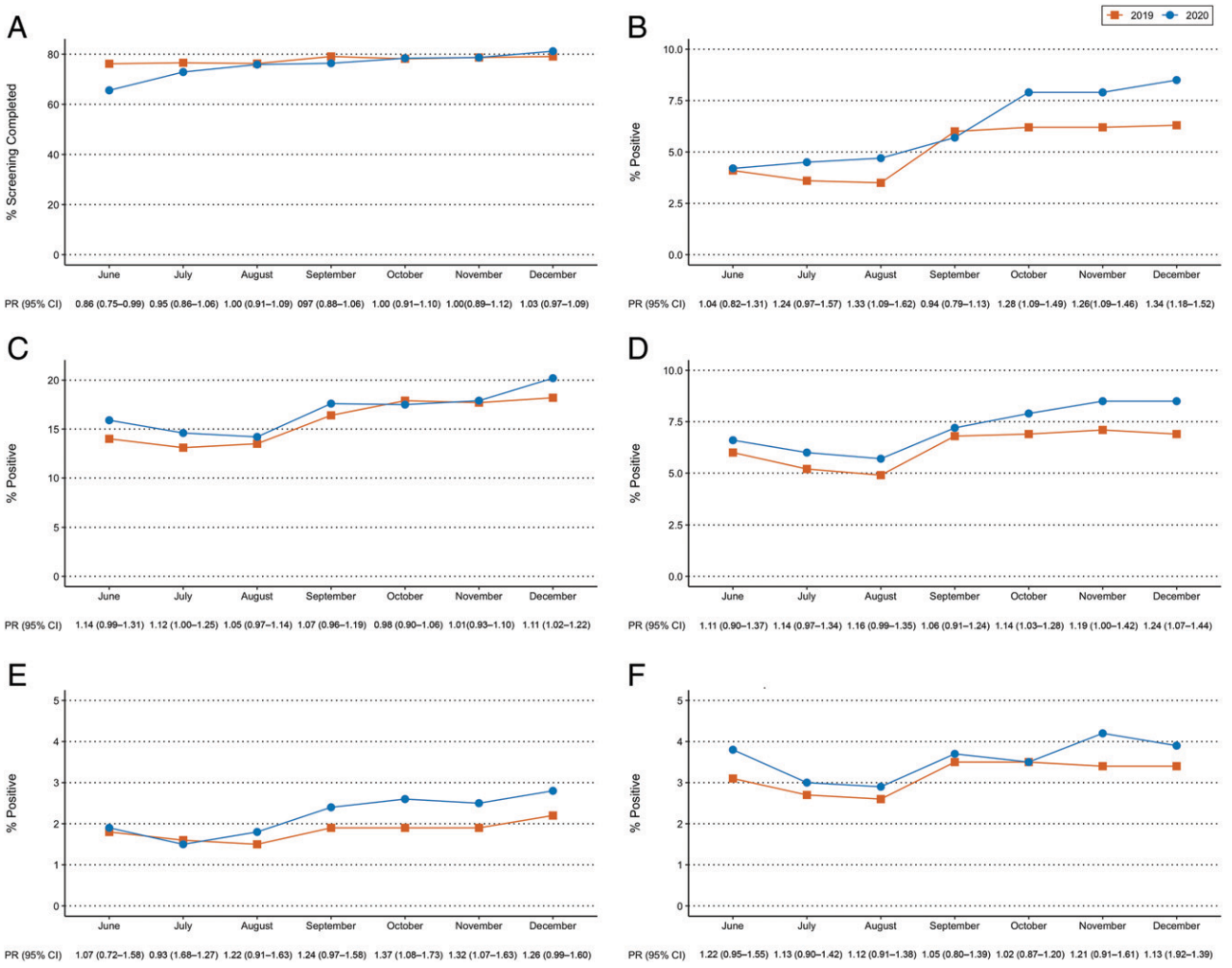

FIGURE 1

Depression and suicide risk screening outcomes by month, comparing prepandemic (2019) to pandemic (2020) periods. Outcomes were A, screening completed; B, moderate to severe depression; C, borderline depression; D, suicide risk; E, past-month suicidal ideation; and F, lifetime suicide attempt. Percentages reflect crude percentage of visits where adolescents were screened, or the crude percentage among those screened who screened positive for depression or suicide risk. PRs reflect the relative change in prevalence of each screening outcome for a given month in the pandemic period compared with the prepandemic period. PRs were calculated by using Poisson regression with robust variance estimates that accounted for clustering of participants within primary care practices.

prepandemic period tended to be largest later in the year (October–December). Although the absolute magnitude of the changes was modest, reflecting the low prevalence of positive screens overall, the relative increase in the percentage of adolescents screening positive for moderate-to-severe depressive symptoms or recent suicidal thoughts was substantial.

The initial decrease in screening prevalence during the pandemic was likely due to infection prevention efforts at practice sites that resulted in reduced tablet use for screening and efforts to room patients as quickly as possible. These workflow changes varied by network site, as demonstrated by the attenuation of sociodemographic differences after accounting for clustering by practice. These patterns suggest that urban practices caring for predominantly lower income, publicly insured, and non-Hispanic Black adolescents may have experienced less of a decline in screening during the early months of the pandemic. However, for depression and suicide risk outcomes, accounting for practice-level differences did not eliminate differences among demographic subgroups, indicating that results were more consistent across practices.

The changes in suicide risk we observed in primary care were smaller than those reported in a recent analysis of ED-based suicide

TABLE 2 Changes in Depression Screening from Prepandemic to Pandemic Periods

	Prepandemic (2019), %	Pandemic (2020), %	Percentage Point Change (95% CI)	Adjusted PR (95% CI)	*P* Interaction
By sex					.14
Female	78.0	76.7	−1.3 (−2.1 to −0.6)	0.98 (0.91 to 1.07)	
Male	77.2	75.0	−2.2 (−3.0 to −1.4)	0.97 (0.89 to 1.06)	
By Race and ethnicity					.55
Non-Hispanic Black	73.3	73.7	0.4 (−0.8 to 1.6)	1.01 (0.83 to 1.22)	
Non-Hispanic white	79.7	77.3	−2.4 (−3.2 to −1.7)	0.97 (0.91 to 1.03)	
Hispanic or Latino	76.8	73.9	−2.9 (−5.1 to −0.7)	0.96 (0.86 to 1.07)	
Asian American	74.9	71.7	−3.2 (−6.0 to −0.5)	0.95 (0.84 to 1.08)	
Other race	77.2	75.6	−1.6 (−3.4 to 0.1)	0.98 (0.90 to 1.06)	
By insurance					.17
Commercial	77.8	75.4	−2.5 (−3.1 to −1.8)	0.97 (0.90 to 1.04)	
Medical assistance	77.9	77.9	0.1 (−1.0 to 1.2)	1.00 (0.86 to 1.16)	
Self-pay or other	59.0	60.5	1.5 (−4.1 to 7.1)	1.03 (0.89 to 1.20)	
By neighborhood income					.29
$11 497–$59 870	72.9	72.6	−0.3 (−1.5 to 0.8)	1.00 (0.81 to 1.23)	
$59 871–$86 620	77.3	74.8	−2.5 (−3.6 to −1.4)	0.97 (0.90 to 1.04)	
$86 621–$111 591	77.2	73.7	−3.6 (−4.7 to −2.5)	0.95 (0.88 to 1.03)	
$111 591–$236 518	83.2	82.2	−1.0 (−1.9 to 0.0)	0.99 (0.90 to 1.09)	

Percentages in 2019 and 2020 reflect crude percentage of visits where adolescents were screened. Percentage point changes reflect the absolute change in screening from the prepandemic (2019) to pandemic (2020) period, with 95% CIs calculated by using logistic regression and marginal standardization. Negative numbers indicate a decline during the pandemic period, whereas positive numbers indicate an increase. Adjusted PRs and interaction *P* values were estimated by using multivariable Poisson models with robust variance estimates that accounted for clustering by primary care practice. PRs reflect the relative change in screening prevalence in the pandemic period compared with the prepandemic period.

risk screens.[10] This may reflect the fact that the PHQ-9-M is routinely administered at preventive visits where adolescents are not specifically seeking care for depression or suicide risk. Adolescents with the most severe suicide risk concerns may have sought care at the ED, and the primary care population may reflect an adolescent sample with fewer social and medical needs. However, authors of a recent study of largely low-income adolescents in an urban primary care network in Ohio also reported higher suicide risk prevalence compared with our network, although they did not find increases in depression or suicide risk during the pandemic.[24] Our larger study population in the Philadelphia area included adolescents from urban, suburban, and semirural areas as well as a wide range of socioeconomic backgrounds, which may contribute to the differences in our findings. However, in the primary care context, even a small increase in adolescents screening positive for suicide risk may have a substantial impact on practice, given the amount of work required to safely engage at-risk adolescents in appropriate services. The mental health system is already overburdened, and many children's hospitals have been overwhelmed by mental health complaints during the pandemic.[3,25] Our findings suggest that female adolescents in particular may be at heightened risk of suicidal ideation during the pandemic, which may have exacerbated national prepandemic trends.[2,26,27]

As with suicide risk, the most consistent increase in depressive symptoms in our analysis was among female adolescents. This also aligns with national prepandemic data[2] and suggests that the pandemic may have exacerbated existing patterns, at least in the Philadelphia region. Social isolation and loneliness are associated with increased risk of depression in children and adolescents,[28] and school closures and other COVID-19 mitigation measures have restricted social interactions among adolescents. Adverse effects of social media (eg, bullying) have been implicated as potential contributors to the greater burden of depression among girls,[2] and these effects may have been magnified during the pandemic as in-person social interactions have declined or shifted online. The increases in depressive symptoms among non-Hispanic Black and non-Hispanic white adolescents during the pandemic are also concerning. National prevalence estimates suggest depression rates are higher among non-Hispanic white and Hispanic adolescents compared with Black and Asian American adolescents.[29] However, Black and Hispanic adolescents may be less likely to receive a depression diagnosis and treatment when needed.[15] Black communities have experienced disproportionate health and economic impacts of COVID-19 as a result of structural racism,[30,31] which may explain the increase in depressive symptoms in Black adolescents and suggest growing unmet mental health needs. In addition, persistent school

TABLE 3 Changes in Depression Screening Outcomes from Prepandemic to Pandemic Periods

	Prepandemic (2019), %	Pandemic (2020), %	Percentage Point Change (95% CI)	Adjusted PR (95% CI)	*P* Interaction
Screened positive for moderate-to-severe depressive symptoms (PHQ-9-M score 11–27)					
By sex					<.001
Female	6.7	9.0	2.3 (1.7 to 2.8)	1.32 (1.24 to 1.42)	
Male	3.3	3.4	0.1 (−0.3 to 0.5)	1.02 (0.89 to 1.67)	
By Race and ethnicity					.02
Non-Hispanic Black	7.0	8.8	1.8 (0.9 to 2.7)	1.24 (1.11 to 1.39)	
Non-Hispanic white	4.0	5.2	1.3 (0.8 to 1.7)	1.29 (1.18 to 1.42)	
Hispanic or Latino	7.9	7.9	0.1 (−1.5 to 1.6)	0.99 (0.81 to 1.21)	
Asian American	4.7	4.1	−0.5 (−2.0 to 1.0)	0.92 (0.67 to 1.27)	
Other race	5.0	6.2	1.2 (0.1 to 2.3)	1.24 (1.00 to 1.54)	
By insurance					.52
Commercial	4.1	5.2	1.1 (0.8 to 1.5)	1.27 (1.16 to 1.39)	
Medical assistance	7.9	9.1	1.2 (0.3 to 2.0)	1.15 (1.04 to 1.26)	
Self-pay or other	6.2	9.6	3.4 (−0.6 to 7.3)	1.69 (0.99 to 2.88)	
By neighborhood income					.20
$11 497–$59 870	7.5	8.6	1.2 (0.3 to 2.0)	1.14 (1.04 to 1.25)	
$59 871–$86 620	5.4	6.8	1.4 (0.7 to 2.1)	1.23 (1.09 to 1.40)	
$86 621–$111 591	4.2	5.3	1.2 (0.5 to 1.8)	1.26 (1.10 to 1.43)	
$111 591–$236 518	3.2	4.4	1.2 (0.7 to 1.8)	1.36 (1.15 to 1.61)	
Screened positive for borderline depressive symptoms (PHQ-9-M score 5–10)					
By sex					.42
Female	17.8	19.4	1.5 (0.7 to 2.3)	1.08 (1.03 to 1.13)	
Male	13.4	14.1	0.7 (0.0 to 1.4)	1.05 (1.00 to 1.10)	
By race and ethnicity					.13
Non-Hispanic Black	21.2	22.0	0.7 (−0.6 to 2.0)	1.03 (0.97 to 1.09)	
Non-Hispanic white	13.2	14.7	1.5 (0.8 to 2.1)	1.10 (1.06 to 1.16)	
Hispanic or Latino	20.0	22.0	2.0 (−0.4 to 4.4)	1.08 (0.97 to 1.22)	
Asian American	13.3	14.7	1.5 (−1.0 to 4.0)	1.12 (0.97 to 1.29)	
Other	15.3	15.0	−0.3 (−2.0 to 1.4)	0.98 (0.89 to 1.08)	
By insurance					<.001
Commercial	13.6	14.8	1.1 (0.5 to 1.7)	1.09 (1.05 to 1.13)	
Medical assistance	21.8	22.3	0.5 (−0.8 to 1.7)	1.02 (0.96 to 1.09)	
Self-pay or other	14.9	21.1	6.2 (0.5 to 11.8)	1.41 (1.06 to 1.87)	
By neighborhood income					.37
$11 497–$59 870	20.3	21.9	1.5 (0.3 to 2.8)	1.07 (1.02 to 1.12)	
$59 871–$86 620	16.5	17.5	1.1 (−0.1 to 2.2)	1.05 (0.99 to 1.11)	
$86 621–$111 591	14.0	15.1	1.1 (0.0 to 2.1)	1.07 (1.00 to 1.15)	
$111 591–$236 518	11.9	13.1	1.2 (0.3 to 2.2)	1.09 (1.01 to 1.17)	

Percentages in 2019 and 2020 reflect crude percentage among those screened who screened positive for depression. Percentage point changes reflect the absolute change in depressive symptoms from the prepandemic (2019) to pandemic (2020) period, with 95% CIs calculated by using logistic regression and marginal standardization. Negative numbers indicate a decline during the pandemic period, whereas positive numbers indicate an increase. Adjusted PRs and interaction *P* values were estimated by using multivariable Poisson models with robust variance estimates that accounted for clustering by primary care practice. PRs reflect the relative change in prevalence of screening positive for depression symptoms in the pandemic period compared with the prepandemic period.

closures and stricter social distancing policies in urban areas may have disproportionately increased isolation among non-Hispanic Black adolescents. Although COVID-19 has also heavily impacted Hispanic communities,[32] and anti-Asian American violence and rhetoric has risen during the pandemic,[33] we did not identify increases in moderate-to-severe depressive symptoms among Hispanic and Asian American adolescents. This is in contrast to national survey data indicating heightened rates of suicidal ideation and attempts among Hispanic youth.[34] However, because there were relatively few Hispanic and Asian American adolescents in our study population, and these groups are not monolithic and represent many nationalities, these findings should be interpreted with

TABLE 4 Changes in Suicide Risk Screening Outcomes from Prepandemic to Pandemic Periods

	Prepandemic (2019), %	Pandemic (2020), %	Percentage Point Change (95% CI)	Adjusted PR (95% CI)	*P* Interaction
Positive screen for suicide risk					
By sex					.07
Female	8.2	9.7	1.5 (0.9 to 2.1)	1.18 (1.11 to 1.26)	
Male	4.1	4.5	0.4 (0.0 to 0.8)	1.09 (0.99 to 1.19)	
By race and ethnicity					.49
Non-Hispanic Black	10.4	11.5	1.1 (0.1 to 2.1)	1.09 (0.99 to 1.20)	
Non-Hispanic white	4.5	5.6	1.1 (0.7 to 1.5)	1.22 (1.14 to 1.32)	
Hispanic or Latino	7.5	8.4	0.9 (−0.7 to 2.5)	1.09 (0.93 to 1.29)	
Asian American	5.5	5.7	0.2 (−1.5 to 1.8)	1.03 (0.74 to 1.45)	
Other race	6.0	6.9	1.0 (−0.2 to 2.1)	1.16 (0.99 to 1.36)	
By insurance					.64
Commercial	4.8	5.7	0.9 (0.5 to 1.3)	1.20 (1.11 to 1.29)	
Medical assistance	10.2	11.2	0.9 (0.0 to 1.8)	1.09 (1.02 to 1.17)	
Self-pay or other	7.9	7.9	0.0 (−0.4 to 0.4)	1.08 (0.73 to 1.61)	
By neighborhood income					.90
$11 497–$59 870	9.7	11.1	1.4 (0.5 to 2.4)	1.13 (1.03 to 1.23)	
$59 871–$86 620	6.2	7.3	1.1 (0.4 to 1.9)	1.15 (1.03 to 1.29)	
$86 621–$111 591	4.8	5.6	0.8 (0.2 to 1.5)	1.15 (1.04 to 1.29)	
$111 591–$236 518	4.1	4.9	0.9 (0.3 to 1.5)	1.20 (1.02 to 1.40)	
Past month suicidal thoughts					
By sex					<.001
Female	2.4	3.2	0.8 (0.4 to 1.1)	1.34 (1.18 to 1.52)	
Male	1.2	1.2	0.0 (−0.2 to 0.2)	1.00 (0.86 to 1.17)	
By race and ethnicity					.16
Non-Hispanic Black	3.6	4.0	0.5 (−0.2 to 1.1)	1.12 (0.96 to 1.30)	
Non-Hispanic white	1.1	1.6	0.5 (0.3 to 0.7)	1.45 (1.27 to 1.65)	
Hispanic or Latino	2.2	2.2	0.0 (−0.8 to 0.9)	1.02 (0.70 to 1.47)	
Asian American	1.8	1.7	−0.1 (−1.1 to 0.8)	0.95 (0.63 to 1.43)	
Other	1.8	2.2	0.4 (−0.3 to 1.0)	1.23 (0.95 to 1.59)	
By insurance					.05
Commercial	1.3	1.6	0.3 (0.1 to 0.5)	1.22 (1.05 to 1.42)	
Medical assistance	3.2	3.9	0.7 (0.2 to 1.3)	1.26 (1.12 to 1.42)	
Self-pay or other	2.0	0.8	−1.1 (−2.9 to 0.6)	0.50 (0.14 to 1.84)	
By neighborhood income					.44
$11 497–$59 870	3.3	3.7	0.3 (−0.2 to 0.9)	1.09 (0.96 to 1.25)	
$59 871–$86 620	1.8	2.3	0.5 (0.1 to 0.9)	1.29 (1.08 to 1.54)	
$86 621–$111 591	1.1	1.6	0.5 (0.2 to 0.9)	1.49 (1.21 to 1.84)	
$111 591–$236 518	1.1	1.4	0.3 (0.0 to 0.6)	1.27 (1.03 to 1.58)	
Lifetime suicide attempt					
By sex					.64
Female	4.3	4.8	0.5 (0.0 to 0.9)	1.09 (1.00 to 1.18)	
Male	2.0	2.3	0.3 (0.0 to 0.6)	1.13 (1.00 to 1.28)	
By race and ethnicity					.49
Non-Hispanic Black	5.9	6.5	0.6 (−0.2 to 1.4)	1.07 (0.95 to 1.21)	
Non-Hispanic white	2.1	2.6	0.4 (0.1 to 0.7)	1.17 (1.05 to 1.31)	
Hispanic or Latino	4.4	4.4	0.0 (−1.2 to 1.2)	0.96 (0.77 to 1.19)	
Asian American	1.9	2.0	0.1 (−0.9 to 1.1)	1.02 (0.65 to 1.62)	
Other	2.7	3.0	0.4 (−0.4 to 1.2)	1.12 (0.92 to 1.36)	
By insurance					.05
Commercial	2.3	2.6	0.3 (0.1 to 0.6)	1.15 (1.06 to 1.26)	
Medical assistance	5.7	6.2	0.5 (−0.2 to 1.2)	1.06 (0.95 to 1.20)	
Self-pay or other	4.8	2.2	−2.5 (−5.2 to 0.2)	0.54 (0.28 to 1.07)	
By neighborhood income					.40
$11 497–$59 870	5.5	6.2	0.8 (0.0 to 1.5)	1.10 (0.98 to 1.25)	
$59 871–$86 620	3.1	3.6	0.6 (0.0 to 1.1)	1.15 (1.01 to 1.32)	
$86 621–$111 591	2.1	2.5	0.3 (−0.1 to 0.8)	1.13 (0.88 to 1.44)	
$111 591–$236 518	2.0	2.1	0.1 (−0.3 to 0.5)	1.01 (0.86 to 1.18)	

Percentages in 2019 and 2020 reflect crude percentage among those screened who screened positive for suicide risk. Percentage point changes reflect the absolute change in suicide risk from the prepandemic (2019) to pandemic (2020) period, with 95% CIs calculated by using logistic regression and marginal standardization. Negative numbers indicate a decline during the pandemic period, whereas positive numbers indicate an increase. Adjusted PRs and interaction *P* values were estimated by using multivariable Poisson models with robust variance estimates that accounted for clustering by primary care practice. PRs reflect the relative change in prevalence of screening positive for suicide risk in the pandemic period compared with the prepandemic period.

caution. Because we lack details regarding potential protective factors (eg, parenting practices, peer supports), the reason for these patterns remains unclear and warrants further investigation. Rates of borderline depressive symptoms, however, increased by a similar amount among Hispanic and Asian American compared with non-Hispanic white adolescents. Closer attention to adolescents with borderline depressive symptoms is needed, because these adolescents may be at risk for more severe depression and suicide in the future.

In addition to the primary care setting, screening for mental health concerns routinely occurs in schools. With the transition to virtual school during the pandemic, primary care may be the only screening opportunity available to many adolescents. The rise in mental health concerns suggests that additional resources may be needed to support clinicians in conducting depression and suicide screening. As one strategy, telehealth has been rapidly adopted during the pandemic to support access to the medical home in the context of physical distancing policies[35] and could be used to expand screening and support follow-up of adolescents with mental health concerns, as highlighted in the recent AAP "Interim Guidance on Supporting the Emotional and Behavioral Health Needs of Children, Adolescents, and Families During the COVID-19 Pandemic."[3] Effective telehealth interventions, however, must take into account the digital divide and the often disparate rates of uptake of these services.[36–38] In addition, the integration of social workers and co-located mental health providers into pediatric primary care can facilitate more successful mental health treatment and follow-up.[39] In our network, half of the practices had integrated behavioral health and only 6 had embedded social workers during the study period. However, many primary care practices nationwide do not have co-located or integrated behavioral health,[40] indicating an opportunity to better support screening and follow-up of adolescents with mental health concerns. Finally, patient-facing strategies, such as educating families to ask their pediatricians about depression screening and resources, could be implemented alongside clinician and systems-focused changes. Advocacy on the part of health systems is needed for ongoing billing reform to support these changes.

A strength of this study is the large and diverse population of adolescents seen in pediatric primary care spanning urban, suburban, and semirural geographic areas. This study was also subject to several limitations. First, the use of routinely collected electronic health record data is inherently limited to adolescents who attend primary care visits. Rates of primary care visit attendance tend to be lower among adolescents than younger children,[41] and patterns may not reflect depressive symptoms or suicide risk among adolescents who do not receive primary care. Adolescents with the most severe symptoms might have bypassed primary care and sought care at the ED for acute concerns. It is also possible that disparities in rates of routine preventive visit attendance may have masked larger differences in depression and suicide risk outcomes by race and ethnicity, because non-Hispanic Black adolescents have lower attendance at preventive visits compared with non-Hispanic white adolescents in several practices in our network with high levels of concentrated poverty. In addition, the COVID-19 pandemic impacted primary care visit volumes. We attempted to account for this by comparing the June to December period after visit patterns had stabilized, but this issue may have introduced bias if adolescents with mental health concerns were differentially more (or less) likely to attend visits during the pandemic. It is also possible, given the lower screening rates during the pandemic, that clinicians were selectively screening adolescent patients they perceive to be higher risk. Despite this possibility, screening activities in the network during the pandemic were driven largely by practices' ability to safely sanitize tablets used for screening. Also, results may not generalize to other geographic regions. Because of limitations in the electronic health record data, we were unable to examine patterns among lesbian, gay, bisexual, transgender, and queer/questioning (LGBTQ) adolescents or according to language preference. Also, given the nature of the PHQ-9-M, interpretations are restricted to depressive symptoms, rather than diagnostic rates of depression. Additional research examining changes in diagnostic rates during the COVID-19 pandemic would be beneficial. Also, we did not have access to details on follow-up and interventions that were put in place for teenagers who screened positive for depression or suicide risk, although this has been examined in other studies.[11,18,24] Studies in which researchers examine patterns of follow-up care provided after positive screens during COVID-19 will be an important next step, given high variability in follow-up after primary care depression and suicide risk screening in general.[11,18] Finally,

future work should be conducted to examine longitudinal, individual-level changes in depressive symptoms and suicide risk in addition to population-level patterns.

CONCLUSION

Positive screens for depressive symptoms and suicide risk increased by a small but significant amount during the COVID-19 pandemic. Increases were most pronounced among female adolescents for both depression and suicide risk screening, with some indication of increases among non-Hispanic white and non-Hispanic Black adolescents. Given these patterns, pediatricians are encouraged to consistently screen adolescents for depression and link identified adolescents to treatment. Additionally, advocacy and effort on the part of primary care practices is needed to ensure adolescents are screened and linked to treatment and that existing gaps between the identification of depression symptoms and/or suicide risk and initiating (and sustaining) treatment are filled, including known barriers to receiving treatment faced by non-Hispanic Black adolescents.

ABBREVIATIONS

AAP: American Academy of Pediatrics
CHOP: Children's Hospital of Philadelphia
CI: confidence interval
COVID-19: coronavirus disease 2019
ED: emergency department
PHQ-9-M: Patient Health Questionnaire-Modified for Teens
PR: prevalence ratio

FINANCIAL DISCLOSURES: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported by the Children's Hospital of Philadelphia.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest relevant to this article to disclose.

REFERENCES

1. Burstein B, Agostino H, Greenfield B. Suicidal attempts and ideation among children and adolescents in US emergency departments, 2007-2015. *JAMA Pediatr*. 2019;173(6):598–600
2. Twenge JM, Joiner TE, Rogers ML, Martin GN. Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time. *Clin Psychol Sci*. 2018;6(1):3–17
3. American Academy of Pediatrics. Interim guidance on supporting the emotional and behavioral health needs of children, adolescents and families during the COVID-19 pandemic. Available at: https://services.aap.org/en/pages/2019-novelcoronavirus-covid–19-infections/clinical-guidance/interim-guidance-on-supporting-the-emotional-and-behavioral-health-needs-of-children-adolescents-and-families-during-the-covid-19-pandemic/. Accessed March 15, 202.
4. Rothe EM, Fortuna LR, Tobon AL, Postlethwaite A, Sanchez-Lacay JA, Anglero YL. Structural inequities and the impact of COVID-19 on Latinx children: implications for child and adolescent mental health practice. *J Am Acad Child Adolesc Psychiatry*. 2021;60(6):669–671
5. Ravens-Sieberer U, Kaman A, Erhart M, Devine J, Schlack R, Otto C. Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany [published online January 25, 2021]. *Eur Child Adolesc Psychiatry*
6. Chen X, Qi H, Liu R, et al. Depression, anxiety and associated factors among Chinese adolescents during the COVID-19 outbreak: a comparison of two cross-sectional studies. *Transl Psychiatry*. 2021;11(1):148
7. Xie X, Xue Q, Zhou Y, et al. Mental health status among children in home confinement during the coronavirus disease 2019 outbreak in Hubei Province, China. *JAMA Pediatr*. 2020;174(9):898–900
8. Patrick SW, Henkhaus LE, Zickafoose JS, et al. Well-being of parents and children during the COVID-19 pandemic: a national survey. *Pediatrics*. 2020;146(4):e2020016824
9. Zhou SJ, Zhang LG, Wang LL, et al. Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *Eur Child Adolesc Psychiatry*. 2020;29(6):749–758
10. Hill RM, Rufino K, Kurian S, Saxena J, Saxena K, Williams L. Suicide ideation and attempts in a pediatric emergency department before and during COVID-19. *Pediatrics*. 2021;147(3):e2020029280
11. Farley AM, Gallop RJ, Brooks ES, Gerdes M, Bush ML, Young JF. Identification and management of adolescent depression in a large pediatric care network. *J Dev Behav Pediatr*. 2020;41(2):85–94
12. Stein RE, Zitner LE, Jensen PS. Interventions for adolescent depression in primary care. *Pediatrics*. 2006;118(2):669–682
13. Zuckerbrot RA, Cheung A, Jensen PS, Stein REK, Laraque D; GLAD-PC STEERING GROUP. Guidelines for Adolescent Depression in Primary Care (GLAD-PC): part I. Practice preparation,

identification, assessment, and initial management. *Pediatrics*. 2018;141(3):e20174081

14. United States Preventive Services Task Force. Depression in children and adolescents: screening. Available at: https://www.uspreventive servicestaskforce.org/uspstf/document/RecommendationStatementFinal/depression-in-children-and-adolescents-screening. Accessed March 8, 2021
15. Thomas JF, Temple JR, Perez N, Rupp R. Ethnic and gender disparities in needed adolescent mental health care. *J Health Care Poor Underserved*. 2011;22(1):101–110
16. Hoffmann JA, Farrell CA, Monuteaux MC, Fleegler EW, Lee LK. Association of pediatric suicide with county-level poverty in the United States, 2007-2016. *JAMA Pediatr*. 2020;174(3):287–294
17. Fiks AG, Grundmeier RW, Margolis B, et al. Comparative effectiveness research using the electronic medical record: an emerging area of investigation in pediatric primary care. *J Pediatr*. 2012;160(5):719–724
18. Davis M, Rio V, Farley AM, Bush ML, Beidas RS, Young JF. Identifying adolescent suicide risk via depression screening in pediatric primary care: an electronic health record review. *Psychiatr Serv*. 2021;72(2):163–168
19. Richardson LP, McCauley E, Grossman DC, et al. Evaluation of the Patient Health Questionnaire-9 Item for detecting major depression among adolescents. *Pediatrics*. 2010;126(6):1117–1123
20. O'Connor BC, Lewandowski RE, Rodriguez S, et al. Usual care for adolescent depression from symptom identification through treatment initiation. *JAMA Pediatr*. 2016;170(4):373–380
21. American Academy of Pediatrics. Bright Futures Tool & Resource Kit. Available at: https://toolkits.solutions.aap.org/DocumentLibrary/BFTK2e_Links_Screening_Tools.pdf. Accessed June 1, 2021
22. Manson S, Schroeder J, Van Riper D, Kugler T, Ruggles S. *IPUMS National Historical Geographic Information System: Version 15.0*. Minneapolis, MN: IPUMS; 2020.
23. Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004;159(7):702–706
24. Kemper AR, Hostutler CA, Beck K, Fontanella CA, Bridge JA. Depression and suicide-risk screening results in pediatric primary care. *Pediatrics*. 2021;148(1):e2021049999
25. Haripersad YV, Kannegiesser-Bailey M, Morton K, et al. Outbreak of anorexia nervosa admissions during the COVID-19 pandemic. *Arch Dis Child*. 2021;106(3):e15
26. Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry*. 2013;70(3):300–310
27. Centers for Disease Control and Prevention. Explore Youth Risk Behavior Survey Questions - United States, 2019. http://yrbs-explorer.services.cdc.gov. Accessed March 22, 2021
28. Loades ME, Chatburn E, Higson-Sweeney N, et al. Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. *J Am Acad Child Adolesc Psychiatry*. 2020;59(11):1218–1239.e3
29. National Institute of Mental Health. Major depression. Available at: https://www.nimh.nih.gov/health/statistics/major-depression.shtml#part_155033. Published 2019. Accessed March 15, 2021
30. Pierce JB, Harrington K, McCabe ME, et al. Racial/ethnic minority and neighborhood disadvantage leads to disproportionate mortality burden and years of potential life lost due to COVID-19 in Chicago, Illinois. *Health Place*. 2021;68:102540
31. Parker K, Horowitz JM, Brown A. About half of lower-income Americans report household job or wage loss due to COVID-19. *Pew Research Center*. April 21, 2020
32. Centers for Disease Control and Prevention. COVID-19 racial and ethnic health disparities. Available at: https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/disparities-deaths.html. 2010. Accessed April 30, 2021
33. Lee S, Waters SF. Asians and Asian Americans' experiences of racial discrimination during the COVID-19 pandemic: impacts on health outcomes and the buffering role of social support. *Stigma Health*. 2021;6(1):70–78
34. Silva C, Van Orden KA. Suicide among Hispanics in the United States. *Curr Opin Psychol*. 2018;22:44–49
35. Fiks AG, Jenssen BP, Ray KN. A defining moment for pediatric primary care telehealth. *JAMA Pediatr*. 2021;175(1):9–10
36. Weber E, Miller SJ, Astha V, Janevic T, Benn E. Characteristics of telehealth users in NYC for COVID-related care during the coronavirus pandemic. *J Am Med Inform Assoc*. 2020;27(12):1949–1954
37. Jackson LA, Zhao Y, Kolenic A III, Fitzgerald HE, Harold R, Von Eye A. Race, gender, and information technology use: the new digital divide. *Cyberpsychol Behav*. 2008;11(4):437–442
38. Swenson K, Ghertner R. *People in Low-Income Households Have Less Access to Internet Services*. Washington, DC: US Department of Health & Human Services; 2020
39. Hodgkinson S, Godoy L, Beers LS, Lewin A. Improving mental health access for low-income children and families in the primary care setting. *Pediatrics*. 2017;139(1):e20151175
40. Mayne SL, Ross ME, Song L, et al. Variations in mental health diagnosis and prescribing across pediatric primary care practices. *Pediatrics*. 2016;137(5):e20152974
41. Rand CM, Goldstein NPN. Patterns of primary care physician visits for us adolescents in 2014: implications for vaccination. *Acad Pediatr*. 2018;18(2S):S72–S78

COVID-19 and Adolescent Depression and Suicide Risk Screening Outcomes

Stephanie L. Mayne, Chloe Hannan, Molly Davis, Jami F. Young, Mary Kate Kelly, Maura Powell, George Dalembert, Katie E. McPeak, Brian P. Jenssen and Alexander G. Fiks

Pediatrics 2021;148;
DOI: 10.1542/peds.2021-051507 originally published online June 17, 2021;

PEDIATRICS®
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

COVID-19 and Adolescent Depression and Suicide Risk Screening Outcomes

Stephanie L. Mayne, Chloe Hannan, Molly Davis, Jami F. Young, Mary Kate Kelly, Maura Powell, George Dalembert, Katie E. McPeak, Brian P. Jenssen and Alexander G. Fiks

Pediatrics 2021;148;
DOI: 10.1542/peds.2021-051507 originally published online June 17, 2021;