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ASSISTANT SECRETARY FOR PLANNING AND EVALUATION

RESEARCH BRIEF

April 9, 2021

MENTAL HEALTH CONSEQUENCES OF COVID-19: THE ROLE OF SOCIAL DETERMINANTS OF HEALTH

KEY POINTS

- A significantly greater percentage (2.7%) of patients with a COVID-19 diagnosis experienced a new onset of mental health condition following their COVID-19 diagnosis compared to patients who tested negative for COVID-19 (1.0%) or had a COVID-19 symptom (1.4%).
- Among patients who experienced a new onset of mental health condition, the most common types were anxiety (70-75%) and major depression (31-33%).
- The odds of developing a mental health condition after COVID-19 diagnosis were significantly higher among individuals with health-related social needs associated with childhood upbringing (odds ratio [OR] 13.3), education (OR 8.3), employment (OR 4.5), or housing (OR 3.5).

POLICY ISSUE

Experts have raised concerns about COVID-19's intersection with mental health since the start of the pandemic, especially among individuals with pre-existing mental health conditions.[1] Individuals with mental health conditions have more chronic medical conditions that increase their risk for contracting severe COVID-19 compared with individuals without any mental health condition.[2] Although researchers have predicted adverse mental health outcomes following a COVID-19 diagnosis,[3,4] few studies quantify the mental health sequelae of COVID-19. Taquet et al. (2020) documented a bidirectional relationship between a COVID-19 diagnosis and mental health conditions but cautioned that their findings could be due to confounding socioeconomic factors that they were unable to take into account.

The pandemic has also raised concerns that social inequalities in health could unevenly impact COVID-19 related mortality and morbidity,[5] with individuals and families living in poverty and disadvantaged conditions being disproportionately impacted. During the COVID-19 pandemic, many low-wage workers have been deemed as essential including agricultural workers, home care workers, grocery store workers, and restaurant workers.[6] In addition, evidence suggests that social determinants of health (SDOH) indicators such as low income, social exclusion, unemployment, adverse childhood experiences, and food and housing insecurity can lead to poor mental health outcomes.[7] Little is known about how the SDOH indicators are correlated with onset of new mental health conditions among individuals who contracted COVID-19. This is an important omission in the literature, as policy responses to the mental health impact of the pandemic could be more effectively formulated if the underlying factors that contribute to adverse mental health outcomes are better understood. Thus, the dual purposes of this brief are: (1) to estimate the rate of new onset of mental health conditions among individuals with a COVID-19 diagnosis who had no mental health conditions or mental health-related health services utilization in the 12 months prior to their COVID-19 diagnosis; and (2) to quantify the contribution of SDOH indicators to the development of the mental health condition.

STUDY DESIGN

The data for the study were drawn from December 2018-January 2021 IQVIA US Open Source Claims, a multi-payer pre-adjudicated health insurance claims database covering all 50 states and Washington, D.C. IQVIA US Open Source Claims includes professional claims generated by office-based physicians (CMS-1500), institutional claims generated by hospitals and other institutions (UB-04), and prescription claims. Analysis was completed using the E360™ Platform and E360™ Analytics Workbench. The version of the data that was accessible to ASPE contains information only on patients who were diagnosed with COVID-19, had a test for COVID-19, or exhibited COVID-19 symptoms such as fever, fatigue, shortness of breath, or cough. Descriptive statistics and logistic regression models were used to estimate the probability of, and risk factors for, developing a mental health condition after a COVID-19 diagnosis. The sample used for analysis includes 14,870,194 individuals who were diagnosed with COVID-19, had a test for COVID-19, or exhibited COVID-19 symptoms and who had no mental health diagnoses or mental health-related services utilization in the past 12 months. To examine the rate of new onset of mental health condition after COVID-19 and to see how this rate differed in comparison to patients who were not diagnosed with COVID-19, the sample was categorized into three mutually exclusive cohorts: (1) those who were diagnosed with COVID-19; (2) those who tested negative for COVID-19 (the "Negative Test cohort"); and (3) those who exhibited symptoms but were not diagnosed with COVID-19 or tested for COVID-19 (the "Symptoms cohort"). Patients with COVID-19 symptoms were examined on the theory that they could represent patients with COVID-19 lacking a diagnosis. The data set available to ASPE did not allow the construction of a matched control cohort to be compared with the patients diagnosed with COVID-19.

Psychiatric conditions were measured by whether the patient had any of the following mental health-related diagnoses after either their COVID-19 diagnosis or COVID-19 test or COVID-19 related symptoms: psychotic disorder, major depression, other mood disorder, anxiety and related disorder, and other mental health conditions. The primary variable of interest related to whether persons had indicators of SDOH as measured by the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) Z codes. The codes relevant for the analysis were whether persons were indicated to have problems related to education and literacy (Z55), employment and unemployment (Z56), occupational risk (Z57), social environment (Z60), childhood upbringing (Z62), primary support including family (Z63), and psychosocial environment (Z64-Z65). Other variables controlled for in the analysis include indicators of hospitalization due to COVID-19; underlying medical conditions associated with higher risk of illness from COVID-19 (asthma, bronchitis, cancer, diabetes, heart disease, hypertension, kidney disease, liver cirrhosis, nicotine dependence and obesity); and demographic characteristics (age and gender).

FINDINGS

Patients with a COVID-19 diagnosis were more likely to experience new onset of a mental health condition compared to patients with either a negative test for COVID-19 or a COVID-19 symptom.

Table 1 displays the percentage of new onset of mental health condition among each cohort and the percentage of the specific type of mental health condition among those who have a new onset of any mental health condition. The incidence of any new onset of mental health condition was higher among the COVID-19 cohort compared to the Symptoms cohort (2.7% vs. 1.4%; $p < 0.001$) and the Negative Test cohort (2.7% vs. 1.0%; $p < 0.001$). The median days to a new mental health diagnosis was lower among the COVID-19 cohort compared to the Negative Test cohort (26 days vs. 56 days; $p < 0.001$) and the Symptoms cohort (26 days vs. 123 days; $p < 0.001$). Among those with any mental health condition, the most common type was anxiety and related disorders for the COVID-19 cohort (75.2%), the Negative Test cohort (71.4%), and the Symptoms cohort (69.5%). Major depression was the next most common mental health condition, with prevalence of 33.1% among the COVID-19 cohort, 31.2% among the Negative Test cohort, and 32.3% among the Symptoms cohort.

Patients with a COVID-19 diagnosis who experienced a new onset of mental health condition were more likely to have severe COVID-19-related risk factors, hospitalizations and SDOH indicators.

Table 2 shows that 27.5% of patients with a new onset of mental health diagnosis following a COVID-19 diagnosis experienced a COVID-19 related hospitalization. The hospitalization rate among patients who did not have a mental health diagnosis was 14.7%. Among patients who were diagnosed with a mental health condition following a COVID-19 diagnosis, rates of medical conditions associated with severe COVID-19 were higher compared to those who did not have a mental health diagnosis. Utilization of Z codes related to SDOH was low across the sample population; however, those with a new onset of mental health condition had a higher rate of any SDOH-related Z code utilization compared to those who did not experience a new onset of mental health condition (3.1% vs 0.6%).

Multivariable logistic regression estimates (Table 3) show that the odds of developing a mental health condition following COVID-19 were higher among individuals with a SDOH Z code--specifically, among patients with SDOH Z codes related to childhood upbringing (OR 13.3, 95% CI 11.8-15.0), housing (OR 3.5, 95% CI 3.3-3.7), employment (OR 4.5, 95% CI 4.0-5.0), or education (OR 8.3, 95% CI 7.3-9.3). Hospitalization due to COVID-19 also was correlated with higher odds of developing a mental health condition (OR 1.6, 95% CI 1.5-1.6). To check whether SDOH Z codes were more strongly correlated with COVID-19 diagnosis than non-diagnosis, logistic regression models were estimated for the Negative Test cohort and the COVID-19 Symptom cohort. The results reported in Appendix Table 1 shows that the SDOH Z codes were also statistically significant among these cohorts, but the magnitudes were larger among the COVID-19 patients.

DISCUSSION

Compared to patients with negative COVID-19 test or COVID-19 symptoms, patients with a COVID-19 diagnosis were more likely to experience a new onset of a mental health condition. Anxiety and major depression were the most common type of mental health condition among patients, regardless of whether they had a COVID-19 diagnosis or not. The findings from the study are consistent with previous research findings that a COVID-19 diagnosis was associated with the development of a mental health condition.[8] However, the incidence rate identified here (2.7%) is lower than what has been reported in the literature. Specifically, Taquet et al. (2020) using electronic health records reported a 5.8% incidence rate of mental health condition among individuals who contracted COVID-19 but had no mental health diagnosis in the past 12 months. The difference between the incidence rate reported here and Taquet et al. (2020) might be attributable to differences in how the 12-month clean period was defined. In the present study, the 12-month clean period was based on either a diagnosis or services utilization related to mental health, whereas the Taquet et al. (2020) based the clean period on diagnosis only. It is possible that Taquet et al. (2020) might have included individuals who utilized health services for their mental health condition without a mental health diagnosis appearing in their electronic health records during the clean period. When a clean-period of mental health diagnosis only was applied to this study, the number of patients with a COVID-19 diagnosis in the study becomes 4,916,785 among whom 232,786 (or 4.7%) experienced a new onset of mental health condition--an estimate closer to what was reported in Taquet et al. (2020). Thus, the present study imparts a conservative bias to the incidence rate of new onset of a mental health condition after COVID-19.

The underlying mechanism between COVID-19 and mental health conditions is not well understood. Biological factors directly related to COVID-19 (compromised immune system, loss of functioning, prolonged hospitalization) and/or social factors (economic instability, housing insecurity, lack of social support) might be associated with a new onset of mental health condition. Future studies could unpack these underlying mechanisms behind new mental health conditions among patients with COVID-19.

SDOH indicators or health-related social needs were a significant predictor of new onset of mental health conditions among patients with COVID-19 after accounting for pre-existing medical conditions associated with severe COVID-19, hospitalization due to COVID-19, and demographic characteristics. Despite the low rate of utilization of the Z codes related to SDOH (see Appendix A for more details), its impact was highly significant and large in magnitude. This is consistent with research that documented underutilization of SDOH Z codes,[9,10,11] even though there is a growing consensus that addressing SDOH is crucial to the overall objective of improving population health.[12]

Research has shown that income inequality is associated with depression prevalence and that adverse childhood experiences along with food and housing insecurity are correlated with anxiety disorder.[13,14] The findings from this study add to this growing body of literature and show that economic insecurity related to employment, education, and housing, along with problems related to social environment and childhood upbringing, can be risk factors in developing mental health conditions among patients with COVID-19, even among those with no recent history of mental illness.

Health systems are beginning to adopt patient-level screening for health-related social needs.[15] For example, many states, health care plans, and providers have recognized the importance of addressing these health-related social needs for Medicaid and CHIP beneficiaries to lower health care costs, improve health outcomes, and increase the cost-effectiveness of health care services and interventions.[16] The mental health profession is advocating for implementation of policies that helps improve education and employment opportunities and reduce adverse childhood experiences, along with development of new mental health treatment regimens.[7] It is estimated that the impact of the COVID-19 pandemic on disadvantaged communities will be long lasting.[5] Thus, integrating health-related social needs into policy efforts designed to tackle the COVID-19 pandemic may help not only to reduce the disparities in health outcomes that are being observed, but also to reduce the onset of mental health conditions that individuals are likely to experience subsequent to their COVID-19 diagnosis.

Table 1: New Onset of Mental Health Condition after COVID-19 Diagnosis compared with other Health Events among Individuals with no Mental Health Related Claims in the Past 12 Months			
	COVID-19 Diagnosis[1] (N = 4,556,217)	Negative COVID-19 Test[2] (N = 8,593,827)	COVID-19 Symptoms[3] (N = 1,720,105)
Any Mental Health Condition*	122,201 (2.7%)	85,182 (1.0%)	24,424 (1.4%)
Median Days to Mental Health Diagnosis*	26	56	123
Type of Mental Health Condition[4]			
Anxiety and Related Disorder*	75.2%	71.4%	69.5%
Major Depression	33.1%	31.2%	32.3%
Other Mood Disorder*	5.5%	6.9%	6.9%
Other Mental Health Condition*	15.4%	10.5%	11.8%
Psychotic Disorder*	6.3%	4.0%	3.3%

1. B97.29, B34.2, U07.1, U07.2
2. U0001, U0002, 87635, 86318, 86328, 86769, 87426, 0202U, 0223U, 0224U
3. cough (R05), shortness of breath (R06.02), fever(R50), fatigue (R53.83)
4. psychotic disorder (F20-F29), major depression (F32, F33); other mood disorder (F30, F31, F34-F39), anxiety and related disorder (F40-F48), and other mental health condition (F53, F60, F63, F68, F90-F94, F99).

* $p < 0.001$

Table 2: Descriptive Statistics of Patients with a COVID-19 Diagnosis by Mental Health Condition			
Variable	**Overall[1] (N = 4,556,217)**	**Mental Health Condition (N = 122,201)**	**No Mental Health Condition (N = 4,434,016)**
Age			
0 - 17*	11.01%	9.08%	11.13%
18 - 24*	10.35%	10.14%	10.36%
25 - 64*	57.38%	53.55%	57.62%
65+	21.26%	27.23%	20.88%
Gender			
Female*	50.53%	60.22%	49.92%
Male*	49.47%	39.78%	50.08%
Severe COVID-19			
Hospitalization*	15.44%	27.50%	14.68%
Health Conditions			
Asthma*	5.66%	10.82%	5.33%
Bronchitis*	5.63%	9.22%	5.40%
Cancer	6.13%	8.18%	6.00%
Diabetes*	15.36%	22.80%	14.89%
Heart Disease*	6.75%	12.30%	6.40%
Hypertension*	23.91%	38.87%	22.96%
Kidney Disease*	10.44%	17.56%	9.99%
Liver Cirrhosis	0.39%	0.80%	0.36%
Nicotine Dependence*	4.56%	9.66%	4.24%
Obesity*	13.00%	21.87%	12.44%
SDOH Measures			
Any SDHOH Measure*	0.75%	3.10%	0.61%
Z55 (Education & Literacy)	0.03%	0.21%	0.02%
Z56 (Employment & Unemployment)	0.05%	0.23%	0.04%
Z57 (Occupational Risk)	0.03%	0.04%	0.03%
Z59 (Housing & Economic Circumstances)	0.17%	0.77%	0.13%
Z60 (Social Environment)	0.07%	0.24%	0.06%
Z62 (Childhood Upbringing)	0.03%	0.29%	0.02%
Z63 (Primary Support)	0.15%	1.01%	0.09%
Z64/Z65 (Psychosocial Event)	0.12%	0.38%	0.11%

* $p < 0.001$

Table 3: Logistic Regression Model of New Onset of Mental Health Condition			
Variable	**Odds Ratio**	**95% Confidence Interval**	**P-value**
Age			
0 - 17 (reference)			
18 - 24	1.23	1.20; 1.25	<0.001
25 - 64	0.93	0.92; 0.95	<0.001
65+	0.9	0.88; 0.92	<0.001
Gender			
Female	1.58	1.57; 1.59	<0.001
Male (reference)			
Severe COVID-19			
Hospitalization	1.56	1.57; 1.59	<0.001
Health Conditions			
Asthma	1.61	1.59; 1.64	<0.001
Bronchitis	1.29	1.27; 1.31	<0.001
Cancer	1.01	0.99; 1.03	0.325
Diabetes	1.05	1.04; 1.06	<0.001
Heart	1.17	1.51; 1.61	<0.001
Hypertension	1.59	1.57; 1.61	<0.001
Kidney Disease	1.17	1.15; 1.18	<0.001
Liver Cirrhosis	1.22	1.16; 1.29	<0.001
Nicotine Dependence	1.78	1.76; 1.81	<0.001
Obesity	1.4	1.38; 1.42	<0.001
SDOH Measures			
Z55 (Education & Literacy)	8.26	7.31; 9.34	<0.001
Z56 (Employment & Unemployment)	4.49	4.02; 5.01	<0.001
Z57 (Occupational Risk)	1.51	0.92; 1.44	0.219
Z59 (Housing & Economic Circumstances)	3.50	3.30; 3.72	<0.001
Z60 (Social Environment)	2.52	2.28; 2.79	<0.001
Z62 (Childhood Upbringing)	13.34	11.84; 15.03	<0.001
Z63 (Primary Support)	8.82	8.33; 9.33	<0.001
Z64/Z65 (Psychosocial Event)	2.45	2.27; 2.65	<0.001
Z64/Z65 (Psychosocial Event)	0.12%	0.38%	0.11%
N		4,556,217	

Appendix Table 1: Logistic Regression Model of New Onset of Mental Health Condition		
SDOH Measures	Negative COVID-19 Test Odds Ratio (95% CI)	COVID-19 Mortality Rate Odds Ratio (95% CI)
Z55 (Education & Literacy)	4.35 (4.00; 4.73)	6.78 (5.91; 7.76)
Z56 (Employment & Unemployment)	5.01 (4.67; 5.38)	4.18 (4.16; 5.56)
Z57 (Occupational Risk)	1.33 (1.15; 1.55)	1.48 (1.14; 1.90)
Z59 (Housing & Economic Circumstances)	4.35 (4.18; 4.53)	3.39 (3.16; 3.63)
Z60 (Social Environment)	2.03 (1.87; 2.20)	1.52 (1.31; 1.77)
Z62 (Childhood Upbringing)	6.68 (6.29; 7.09)	5.19 (4.66; 5.79)
Z63 (Primary Support)	5.52 (5.33; 5.74)	4.64 (4.35; 4.96)
Z64/Z65 (Psychosocial Event)	1.83 (1.73; 1.94)	2.47 (2.21; 2.75)
Models controls for demographic characteristics, COVID-19 related hospitalization and health conditions.		

APPENDIX A. UNDERUTILIZATION OF SOCIAL DETERMINANTS OF HEALTH Z CODES

Utilization of SDOH Z codes in less than 1% of the patient identified in this study is consistent to what was observed in prior research.[9,11,17] A recent study of Medicare Fee-for beneficiaries found that less than 1% of the patients had an SDOH related Z codes in their claims.[9] The study also reported that patient with SDOH Z codes were younger; more likely to be male; more likely to be Black; and were more likely to have a behavioral health diagnosis, especially alcoholism, drug disorders, and mental health conditions. The data source utilized here is limited in the number of patient demographic characteristics, and the study was not able to explore how the role of COVID-19 and SDOH measures on mental health may differ by these characteristics. Research has documented substantial health disparities by race/ethnicity related to the COVID-19 pandemic, and it is possible that communities of color are more likely to develop mental health conditions as a result of a COVID-19 diagnosis. More research is needed to explore racial disparities in new onset of mental health condition after a COVID-19 diagnosis. This study was also unable to identify the providers who might be utilizing the SDOH Z codes, but the literature documents mental health providers and large private non-for-profit urban teaching hospitals to be more likely to utilize them.[9,17] It is likely that the patients assigned the SDOH Z codes may have more severe health conditions that might have prompted the providers to assign those Z codes. As such, the underutilization of SDOH Z codes here imparts a conservation bias to the estimates. However, a reason for the low utilization of the SDOH related Z-codes may be that no current national financial incentives exist to code the SDOH indicators. They are not included in any risk adjustment models for health care organization performance evaluation or federal value-based payment programs, and therefore may not be the focus of documentation improvement efforts by billing departments and coding experts to the degree that clinical comorbidities have been.[17]

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