Coronavirus and Mental Health

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THE WHITE HOUSE
WASHINGTON

"All the News That's Fit to Print"

The New York Times

Late Edition

Today, morning clouds giving way to sunshine by the afternoon, high 65. **Tonight,** cloudy, low 54. **Tomorrow,** clouds giving way to sunshine, high 70. Weather map is on Page 23.

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U.S. DEATHS NEAR 100,000, AN INCALCULABLE LOSS

They Were Not Simply Names on a List. They Were Us.

Numbers alone cannot possibly measure the impact of the coronavirus on America, whether it is the number of patients treated, jobs interrupted or lives cut short. As the country nears a grim milestone of 100,000 deaths attributed to the virus, The New York Times scoured obituaries and death notices of the victims. The 1,000 people here reflect just 1 percent of the toll. None were mere numbers.

Patricia Dowd, 57, San Jose, Calif., auditor in Silicon Valley · **Marion Krueger**, 85, Kirkland, Wash., great-grandmother with an easy laugh · **Jermaine Ferro**, 77, Lee County, Fla., wife with little time to enjoy a new marriage · **Cornelius Lawyer**, 84, Bellevue, Wash., sharecropper's son · **Loretta Mendoza Dionisio**, 68, Los Angeles, cancer survivor born in the Philippines · **Patricia Frieson**, 61, Chicago, former nurse · **Luis Juarez**, 54, Romeoville, Ill., traveled often in the United States and Mexico · **Merle C. Dry**, 55, Tulsa, Okla., ordained minister · **Alan Lund**, 81, Washington, conductor with "the most amazing ear" · **Black N Mild**, 44, New Orleans, bounce D.J. and radio personality · **Michael Mika**, 73, Chicago, Vietnam veteran · **John Cofrancesco**, 52, New Jersey, administrator at a nursing facility · **Donald Raymond Haws**, 88, Jacksonville, Fla., administered Holy Eucharist to hospital patients · **Fred Walter Gray**, 75, Benton County, Wash., liked his bacon and hash browns crispy · **JoAnn Stokes-Smith**, 87, Charleston, S.C., loved to travel and covered much of the globe · **Ronald W. Lewis**, 68, New Orleans, preserver of that city's performance traditions · **John-Sebastian Laird-Hammond**, 59, Washington, D.C., member of a Franciscan monastery · **Carl Redd**, 62, Chicago, squeezed in every moment he could with his only grandchild · **Larry Rathgeb**, 90, West Bloomfield Hills, Mich., engineer behind the first 200-m.p.h. stock car · **Alvin Elton**, 56, Chicago, followed in his father's footsteps as a pipefitter · **Arnold Obey**, 73, San Juan, Puerto Rico, educator and marathoner · **Donald J. Horsfall**, 72, Rydal, Pa., co-wrote nine books about computing · **Kevin Charles Patz**, 64, Seattle, active in the AIDS Foundation · **Mike Longo**, 83, New York City, jazz pianist, composer and educator · **Walter Robb**, 91, New York, former General Electric Co.

real jokester · **Michael Sorkin**, 71, New York City, champion of social justice through architecture · **George Valentine**, 66, Washington, D.C., lawyer who mentored others · **James Quigley**, 77, Chicago, rebel of the family · **Sherman Pittman**, 61, Chicago, dedicated his life to his church and his neighborhood · **Susan McPherson Gottsegen**, 74, Palm Beach, Fla., loyal and generous friend to many · **Andreas Koutsoudakis**, 59, New York City, trailblazer for TriBeCa · **Bob Barnum**, 64, St. Petersburg, Fla., leader in Florida Pride events · **Noel Sinkiat**, 64, Olney, Md., nurse planning for retirement · **Thomas E. Anglin**, 85, Cumming, Ga., created many wonderful memories for his family · **Robert Manley Argo Jr.**, 75, South Bay, Calif., member of Del Amo Flyers · **Michael McKinnell**, 84, Beverly, Mass., architect of Boston's monumental City Hall · **Huguette Dorsey**, 94, Somerville, N.J., coached several championship-winning junior high girls basketball teams · **Lynne Sierra**, 68, Roselle, Ill., grandmother who was always full of ideas · **Louvenia Henderson**, 44, Tonawanda, N.Y., proud single mother of three · **Carol Sue Rubin**, 69, West Bloomfield, Mich., loved travel, mahjong and crossword puzzles · **Marion Lucille Kujda**, 92, Royal Oak, Mich., would use chalk and oil paints to capture family portraits · **Alice Chavdarian**, 92, Michigan, loving, generous and adventurous spirit · **Bassey Offiong**, 25, Michigan, saw friends at their worst but brought out their best · **Bobby Joseph Hebert**, 81, Cut Off, La., a 33-year career with the Louisiana Department of Transportation · **Minette Goff Cooper**, 79, Louisiana, loved big and told people she loved them all the time · **Jéssica Beatriz Cortez**, 32, Los Angeles, immigrated to the United States three years ago · **Marie Caronia**, 84, Inwood, N.Y., iconic figure in the Inwood community · **April Dunn**, 33, Baton Rouge, La., advocate for disability rights · **Cedric Dixon**, 48, New York City, police detective in Harlem with a gift for interrogation · **William Helmreich**, 74, Great Neck, N.Y., sociologist who walked New York City · **Harvey Bayard**, 88, New York, grew up directly across the street from the old Yankee Stadium · **Maxwell M. Mozell**, 90, Syracuse, N.Y., founded the Association for Chemoreception Sciences · **Timothy J. Liszewski**, 60, Columbia, S.C., active member of the South Carolina Progressive Network · **Eastern Stewart Jr.**, 71, Annapolis, Md., veteran with a gift for peacemaking · **Freda Ocran**, 51, New York City, nurse with a zest for travel and knowledge · **Douglas Hickok**, 57, Pennsylvania, military's first virus casualty · **Luiza Ogorodnik**, 84, Skokie, Ill., emigrated from Ukraine · **Thomas A. Real**, 61, New-

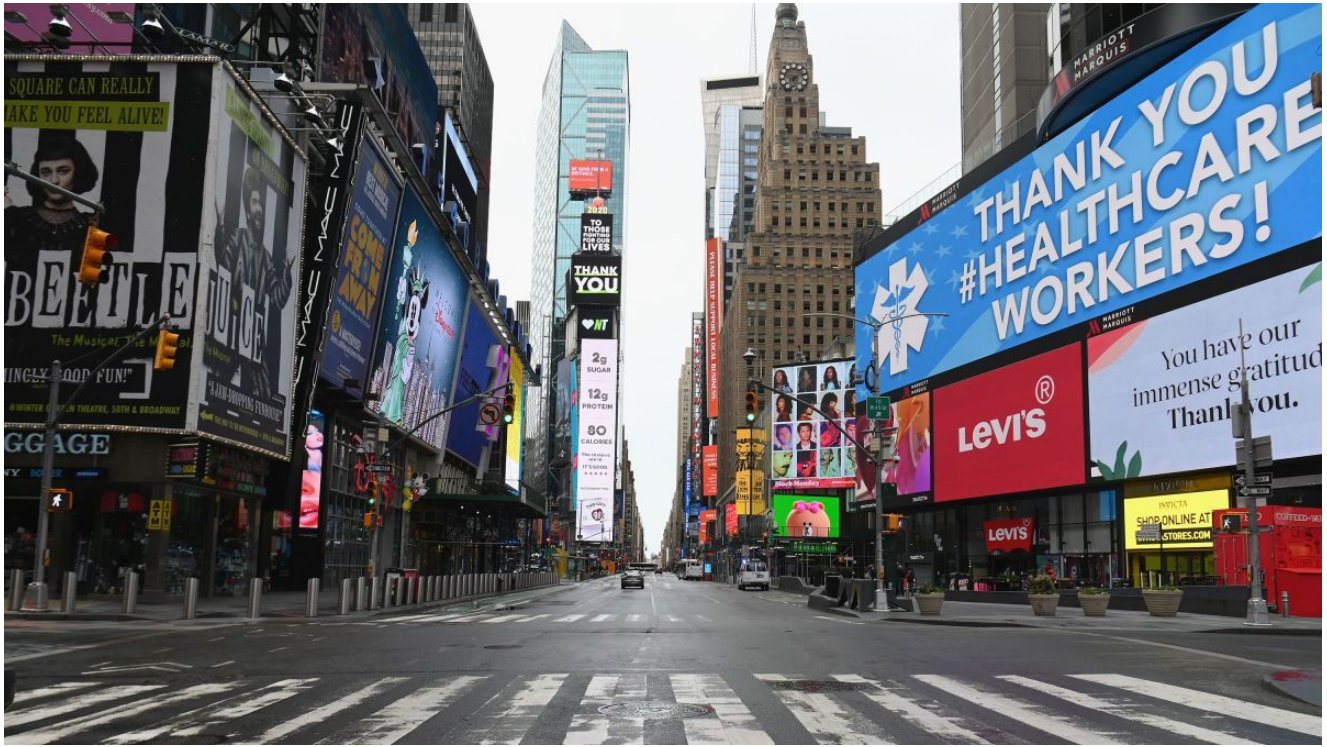
jazz trumpet virtuoso · **Cristina**, 64, New York City, downtown New York singer with a cult following · **Robert H. Westphal**, 75, Fond du Lac, Wis., statesman in the construction industry · **Clair Dunlap**, 89, Washington, pilot still teaching people to fly at 88 · **Marylou Armer**, 43, Sonoma Valley, Calif., veteran police detective · **Regina D. Cullen**, 81, Shrewsbury, Mass., small in stature but strong in spirit · **Sandra Santos-Vizcaino**, 54, New York City, beloved public school teacher · **Frank Gabrin**, 60, New York City, emergency room doctor who died in husband's arms · **Sterling E. Matthews**, 60, Midlothian, Va., cancer survivor who served as a deacon · **Alby Kass**, 89, California, lead singer of a Yiddish folk group · **Roger Eckart**, 78, Indiana, retired firefighter and old-school barber · **Martin Douglas**, 71, New York City, maestro of a steel-pan band · **Daniel Spector**, 68, Memphis, mentor to other Memphis artists · **Mary Minervini**, 91, Oak Lawn, Ill., sign-language interpreter · **Salomon S. Podgursky**, 84, Morristown, N.J., loved to figure out how things worked · **Dale E. Thurman**, 65, Lexington, Ky., tailor known for his exacting work and strong opinions · **Ellis Marsalis**, 85, New Orleans, jazz pianist and patriarch of a family of musicians · **Richard Passman**, 94, Silver Spring, Md., rocket engineer in the early days of supersonic flight · **David Driskell**, 88, Hyattsville, Md., champion of African-American art · **Bucky Pizzarelli**, 94, Saddle River, N.J., master of jazz guitar · **Tarlach MacNiallais**, 57, New York City, Belfast-born fighter for L.B.G.T. and disability rights · **Antonio Checo**, 67, New York City, social worker · **Albert Petrocelli**, 73, New York City, fire chief who answered the call on 9/11 · **Adam Schlesinger**, 52, Poughkeepsie, N.Y., songwriter for rock, film and the stage · **Frederick Brown Starr**, 87, Greensboro, N.C., liked the mental challenges of business · **Douglas Alan Roberts**, 69, Vancouver, Wash., authority on aviation · **Muriel M. Going**, 92, Cedarburg, Wis., taught her girls sheepshead and canasta · **Beverly Collins**, 83, Portland, Maine, longtime registered nurse and hospital volunteer · **Scott Melter**, 60, Wyoming, Minn., worked as an engineer with Comcast · **Florencio Almazo Morán**, 65, New York City, one-man army · **Jennifer Robin Arnold**, 67, New York City, Broadway costume dresser · **John Nakawatase,** 62, Lincolnwood, Ill., coach and Scout leader · **Jesus Roman Melendez**, 49, New York, famous in family circles for his birria beef stew · **Ralph Plaisance**, 87, Massapequa, N.Y., "we called him the Grand Poobah" · **Audrey Malone**, 68, Chicago, sang gospel music as a member of the Malone Sisters · **Terrence George**

Bailargeon, 72, Dennisport, Mass., true outdoorsman · **Viraf Darukhanawalla**, 77, Hoffman Estates, Ill., worker at O'Hare International Airport · **Chester Dwulet**, 68, Burlington, Mass., proud Union Ironworker of Local 7 for 45 years · **John Timothy Barr**, 76, Rochester Hills, Mich., trustee for the Retired Detroit Police and Firefighters Association · **Julie Butler**, 62, New York City, veterinarian who served Harlem · **Lila A. Fenwick**, 87, New York City, first black woman to graduate from Harvard Law School · **Vincent Lionti**, 60, New York City, Met Opera violist and youth orchestra conductor · **Ann Youngerman Smoler**, 87, New York City, had a passion for social justice · **Thomas Waters**, 56, New York City, armed the affordable housing movement with data and analysis · **Luke Workoff**, 33, Huntington, N.Y., his relentless passion was for his family and friends · **José Díaz- Ayala**, 38, Palm Beach, Fla., served with the Palm Beach County Sheriff's Office for 14 years · **Antonio Nieves**, 73, Chicago, always seemed to be busy with some home project · **Jeanne Hammond Byrnes**, 97, Danbury, Conn., received numerous awards for her accounting skills · **Alice Coopersmith Furst**, 87, Kentfield, Calif., in the first class of girls admitted to the Bronx High School of Science · **Bobby Lee Barber**, 84, Buckley, Wash., Seahawks season-ticket holder · **Thomas A. Adamavich**, 78, Sheboygan, Wis., especially proud of his Lithuanian heritage · **Kyra Swartz**, 33, New York, volunteered for pet rescue organizations · **Rhoda Hatch**, 73, Chicago, first in her family to graduate college · **Regina Dix-Parsons**, 75, Schenectady, N.Y., stalwart church gospel singer · **Lakisha Willis White**, 45, Orlando, Fla., was helping to raise some of her dozen grandchildren · **Barbara Yazbeck Vethacke**, 74, St. Clair Shores, Mich., she was known to many as Babs · **June Beverly Hill**, 85, Sacramento, no one made creamed potatoes or fried sweet corn the way she did · **Kimarlee Nguyen**, 33, Everett, Mass., writer who inspired her Brooklyn high school students · **Kamal Ahmed**, 69, New York City, hotel banquet worker and Bangladeshi leader · **Raymond Copeland**, 46, New York City, sanitation worker living his fullest days · **Israel Sauz**, 22, Broken Arrow, Okla., new father · **Lester Eber**, 82, New York, worked for over six decades in the wine and liquor industry · **Harry P. Misthos**, 87, San Francisco Bay Area, Calif., loved the ocean and enjoyed swimming and boating · **Leo Sreebny**, 98, Seattle, preferred bolo ties to neckties, suspenders to belts · **Robert Barghaan**, 88, New York City, could fix almost anything · **Patricia H. Thatcher**, 79, Clifton Park, N.Y., sang

spirit · **Jack Butler**, 78, Indiana, lived in the house he grew up in · **Susan Grey Hopp Crofoot**, 97, Westwood, N.J., took great joy in writing little ditties under her pen name, Penelope Penwiper · **James David Gewirtzman**, 72, New City, N.Y., spent some of his happiest hours hiking in the Adirondacks · **Henry F. Graff**, 98, Greenwich, Conn., Columbia University historian of U.S. presidents · **Mari Jo Davitto**, 82, Thornton, Ill., people were her hobby · **Yaakov Perlow**, 89, New York City, leader of the Novominsker Hasidic dynasty · **Joseph F. Kelly**, 81, New York City, did two tours through the Panama Canal to Antarctica · **John Prine**, 73, Nashville, country-folk singer who was a favorite of Bob Dylan · **Perry Buchalter**, 63, Florida, quiet hero · **Monica Maley**, 74, Rehoboth Beach, Del., loved animals, had dogs and cats, and rode horses · **Thomas Tarbell Russell**, 83, Longmeadow, Mass., mentored by the computer science pioneer Grace Hopper · **Ruth Skapinok**, 85, Roseville, Calif., backyard birds were known to eat from her hand · **Faralyn Havir**, 92, Minnesota, her favorite thing was meeting new people · **Torrin Jamal Howard**, 26, Waterbury, Conn., gentle giant, athlete and musician · **James O'Brien Johnson**, 74, Joplin, Mo., pastor of Mt. Sinai Church of God in Christ · **Joseph W. Hammond**, 64, Chicago, stopped working to look after his aging parents · **Morris Loeb**, 90, Northbrook, Ill., endlessly curious, never really finished · **Dante Dennis Flagello**, 62, Rome, Ga., his greatest accomplishment was his relationship with his wife · **Tommie Adams**, 71, Chicago, moved antiques for more than 25 years · **Myra Helen Robinson**, 57, Detroit, more adept than many knew · **Roger Mckinney-Wagner**, 73, Lowell, Mass., professor at the Salter School · **Sean Christian Keville**, 47, New Providence, N.J., enjoyed talking sports with family · **John Herman Clomax, Jr.**, 62, Newark, one of the few African-American corporate bond traders on Wall Street · **José Torres**, 73, New York City, restaurateur favored by salsa music's stars · **Stuart Cohen**, 73, New York City, Brooklyn cabbie who found a home in Buddhism · **Johnnie D. Veasley**, 76, Country Club Hills, Ill., teacher's aide · **Mary M. Desole**, 93, Poughkeepsie, N.Y., member of the Literacy Volunteers of America · **Vera Flint**, 97, Beverly, Mass., face behind the counter at a family-owned grocery store · **Mike Field**, 59, Valley Stream, N.Y., first responder during the 9/11 attacks · **Chianti Jackson Harpool**, 51, Baltimore, social worker and then a political fundraiser · **Conrad Duncker**, 99, Chicago, longtime dentist · **Peter Kafkis**, 91, Chicago, worked mostly factory jobs to support his family · **Clara Louise**

II, 69, Fremont, Ohio, known throughout Ohio for his knowledge of local history · **Harley E. Acker**, 79, Troupsburg, N.Y., discovered his true calling when he started driving a school bus · **Arlola Rawls**, 81, Chicago, caretaker of her neighborhood · **Roger Liddell**, 65, Flint, Mich., brought smiles to everyone he interacted with · **Luther Coleman**, 108, Evergreen Park, Ill., man who seemed to know everything · **Denise Camille Buczek**, 72, Bristol, Conn., loved writing birthday and holiday cards, poems and lists · **Charles Constantino**, 86, Menlo Park, N.J., worked 40 years for The New York Times · **Ben Doherty**, 83, Boston, stockbroker who founded Doherty Financial Services · **John Horton Conway**, 82, New Brunswick, N.J., mathematician known as the "magical genius" · **Stanley Chera**, 77, New York City, developer and friend of the president · **Robby Browne**, 72, New York City, Realtor and philanthropist who socialized with celebrities · **Wynn Handman**, 97, New York City, acting teacher and a founder of the American Place Theater · **Adam Kovacs**, 72, New York City, cartoonist and an expert on musicals · **Peter Brown**, 53, New Jersey, manager of the S.W. Brown & Son Funeral Home · **Irene Gasior**, 94, Pennsylvania, great-grandmother with a flair for pizzelles · **Stanley L. Morse**, 88, Stark County, Ohio, trombonist who once turned down an offer to join Duke Ellington's orchestra · **Margaret Laughlin**, 91, Massachusetts, had a mystic's direct sense of wonder and oneness · **Cynthia Whiting**, 66, La Plata, Md., retiree determined to spoil her granddaughter · **Steve Joltin**, 75, Rockville, Md., I.T. manager with "an eye for beautiful and unusual things" · **Gerald Glenn**, 66, Richmond, Va., police officer turned pastor · **Maclear Jacoby Jr.**, 93, Washington, D.C., inspiring math teacher · **Doris Mae Burkhart Kale**, 98, Pennsylvania, excelled in the kitchen · **Josephine Posnanski**, 98, New Jersey, loved to dance · **Phil Langley**, 83, Frankfort, Ill., member of Harness Racing Hall of Fame · **Vinton Timely Mason**, 86, Beaumont, Mich., co-owned the Bark-and-All logging company · **Maria Garcia-Rodelo**, 52, Nevada, would walk her children to school every morning · **Fernando Miteff**, 60, New York City, graffiti artist with a generous spirit · **John Watson**, 73, Philadelphia, anywhere he went, he took pictures · **Joyce Posson Winston**, 93, North Bergen, N.J., editor at the Ladies' Home Journal · **John B. Lynch**, 76, Wilmington, Mass., lifelong educator · **Orlando Moncada**, 56, Bronxville, N.Y., left Peru and grabbed hold of the American dream · **John Schoffstall**, 41, Terre Haute, Ind., volunteer youth football coach · **Theodore Gaffney**, 92, Washington,


WINNER BEST MUSICAL
BILLY ELLIOT
WHERE MAXIMUM PERFORMANCE LIVES
maxell
MAMMA MIA!
TOSHIBA
Helped injured opponent win.
SPORTSMANSHIP
Bank of America


SQUARE CAN REALLY
AKE YOU FEEL ALIVE!
BEETLE JUICE
The Musical
GGAGE
THANK YOU
2020
TO THOSE FIGHTING FOR OUR LIVES
2g SUGAR
12g PROTEIN
80 CALORIES
MARRIOTT MARQUIS
THANK YOU #HEALTHCARE WORKERS!
You have our immense gratitud
Thank you.
Levi's
SHOP ONLINE AT

How does the post-COVID environment affect mental health in the United States?

Step-Down Research Questions

1. Is there a difference between depression and anxiety levels pre vs. post-COVID in the US?

2. Is there a relationship between the level of new COVID cases per US state and depression and anxiety levels?

3. Does the level of COVID-related restrictions in US states have a relationship with depression and anxiety levels?

Methodology

The New York Times

Variables

1. “Depression” search popularity (0 - 100).
2. “Anxiety” search popularity (0 - 100).
3. New COVID-19 cases per 100,000 residents (low, medium, high).
4. Restriction level (low, medium, high).

Hypothesis testing

1. *Comparing "depression" and "anxiety" searches between April 2018 (pre-COVID-19) and April 2020* (post-COVID-19)

   Wilcoxon signed-rank test

2. *Association between new COVID-19 cases per 100,000 residents and "depression" or "anxiety" searches in April 2020*:

   Kruskal-Wallis test.

   Rank sum step-down tests.

3. *Association between Restriction Severity and "depression" searches in April 2020*:

   Kruskal-Wallis tests.

   Rank sum step-down tests.

Results

"Depression" searches in April 2018 vs. April 2020.

Null: there is no difference in the median amount of "depression" searches in the US between April 2020 and April 2018.

Alternative: there is a significant difference…

P-value: 1

$\alpha = 0.05$

Fail to reject null.

"Anxiety" searches in April 2020 vs. April 2018.

Null: there is no difference in median "anxiety" searches in the US between April 2020 and April 2018.

Alternative: there is a significant difference…

P-value: 0.4227

$\alpha = 0.05$

Fail to reject null.

Association between "depression" searches and new COVID-19 cases per 100,000 residents in April 2020.

Null: there is no significant difference between the median "depression" searches of states with low COVID cases, medium COVID cases, and high COVID cases.

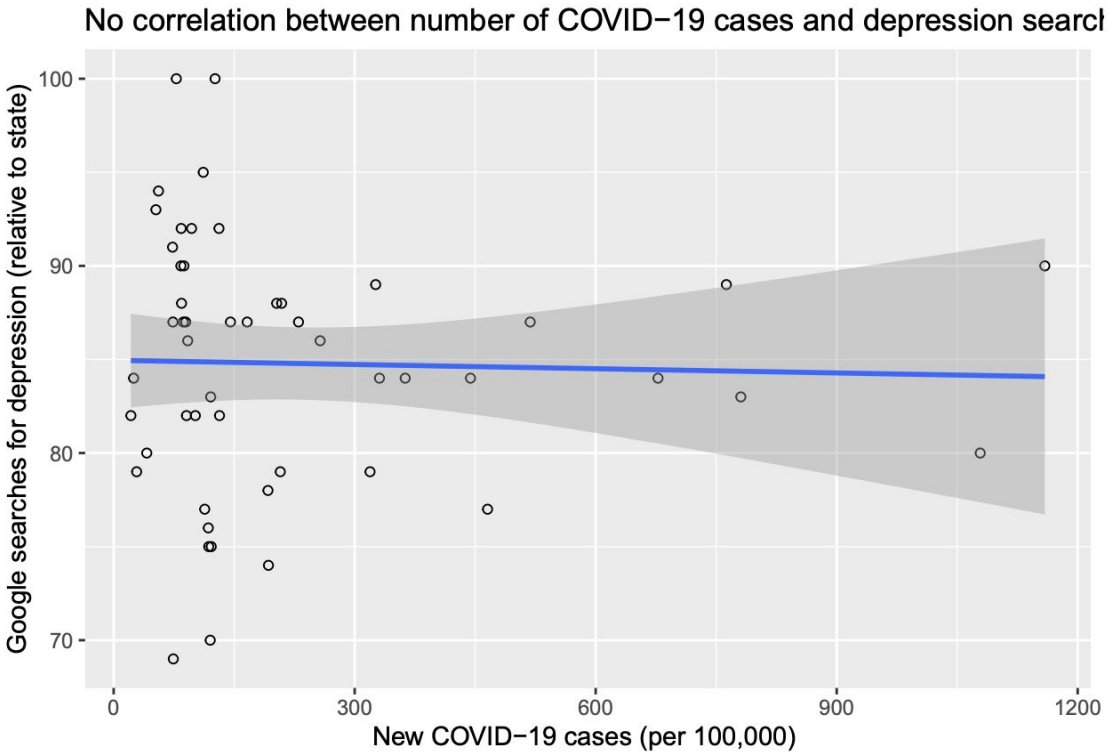
Alternative: there exists at least one difference in the group medians.

Chi-square value: 1.33

P-value: 0.1814

$\alpha = 0.05$

Fail to reject null.


No correlation between number of COVID−19 cases and depression searcl
Google searches for depression (relative to state)
100
90
80
70
0
300
600
900
1200
New COVID−19 cases (per 100,000)

Association between "anxiety" searches and new COVID-19 cases per 100,000 residents in April 2020.

Null: there is no significant difference between the median "anxiety" searches of states with low COVID cases, medium COVID cases, and high COVID cases.

Alternative: there exists at least one difference in the group medians.

Chi-square value: 7.4355

P-value: 0.02429

$\alpha = 0.05$

Adjusted α = 0.0167

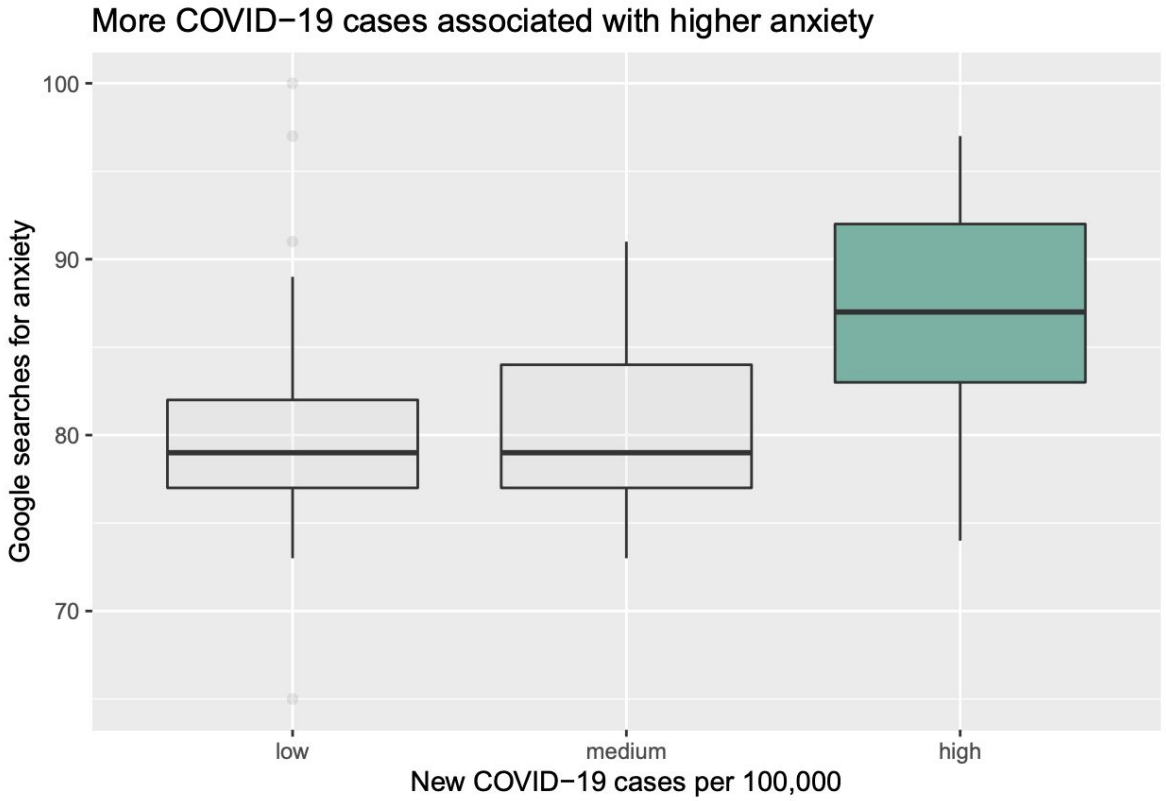
Have sufficient evidence to reject null and conclude alternative.

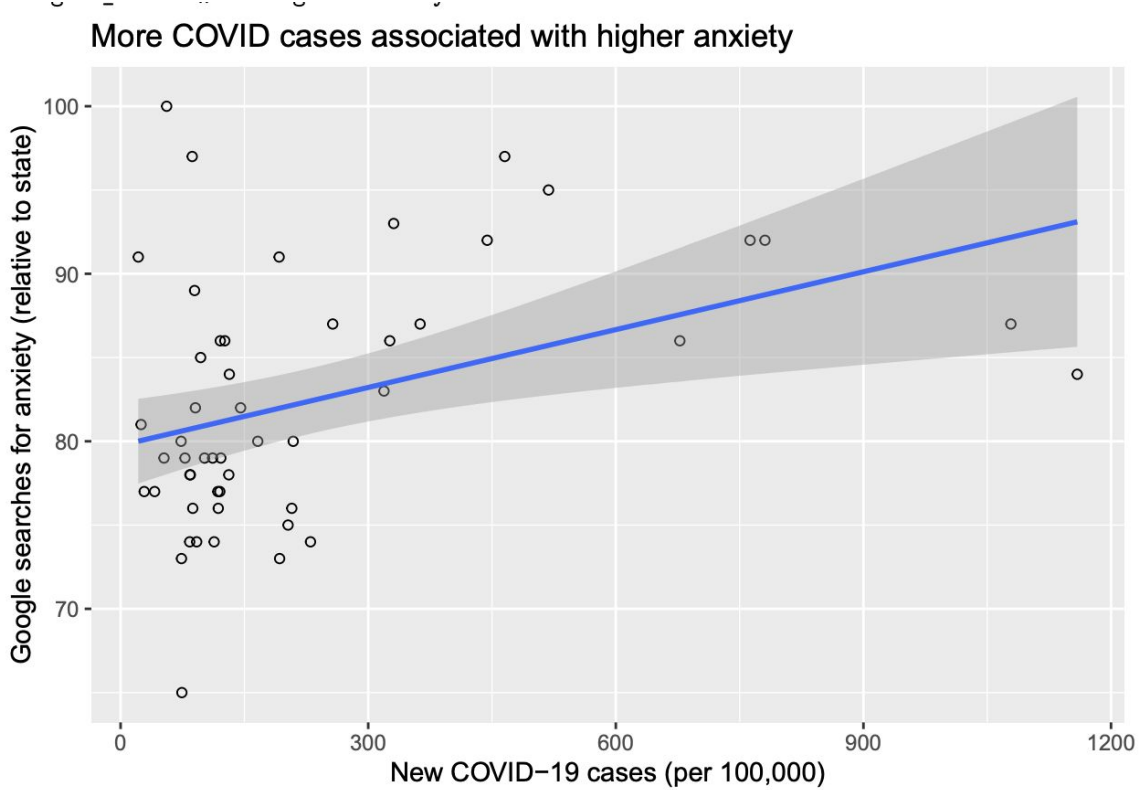
Step-down tests (new COVID-19 cases vs. "anxiety")

1. Low vs. medium COVID-19 cases
    a. P-value: 0.9862
    b. Fail to reject null.

2. Low vs. high COVID-19 cases
    a. P-value: 0.0534
    b. Fail to reject null.

3. Medium vs. high COVID-19 cases
    a. P-value: 0.0067
    b. Have sufficient evidence to reject null.


More COVID−19 cases associated with higher anxiety
Google searches for anxiety
100
90
80
70
low
medium
high
New COVID−19 cases per 100,000


More COVID cases associated with higher anxiety
Google searches for anxiety (relative to state)
100
90
80
70
0
300
600
900
1200
New COVID−19 cases (per 100,000)

Association between "depression" searches and restriction severity in April 2020.

Null: is that there is no significant difference between the median "depression" searches of states with low, medium, and high restriction levels.

Alternative: there is a significant difference…

Chi square value: 1.723

P-value: 0.4225

$\alpha = 0.05$

Fail to reject null.

Association between "anxiety" searches and restriction severity in April 2020.

Null: is that there is no significant difference between the median "anxiety" searches of states with low, medium, and high restriction levels.

Alternative: there exists at least one difference in the group medians.

Chi-square value: 12.719

P-value: 0.00173

$\alpha = 0.05$

Adjusted α = 0.0167

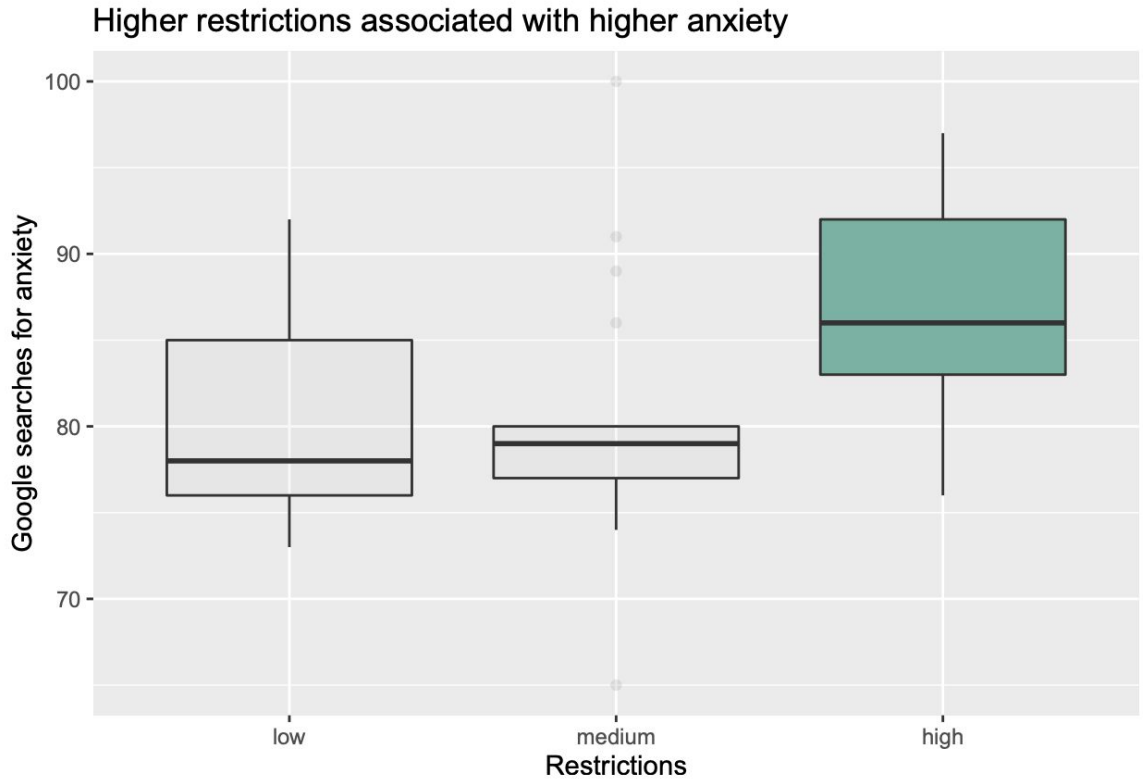
Have sufficient evidence to reject null and conclude alternative

Step-down tests (restriction severity vs. "anxiety")

1. Low vs. medium restriction severity
    a. p-value: 0.8356
    b. Fail to reject null.

2. Low vs. high restriction severity
    a. p-value: 0.0021
    b. Sufficient evidence to reject null.

3. Medium vs. high restriction severity
    a. p-value: 0.0023
    b. Sufficient evidence to reject null.


Higher restrictions associated with higher anxiety
Google searches for anxiety
100
90
80
70
low
medium
high
Restrictions

Discussion

Step-Down Research Questions

1. Is there a difference in depression and anxiety levels pre vs. post-COVID in the US?
   Findings: No significant difference.

2. Is there a relationship between the level of new COVID cases per US state and depression and anxiety levels?
   Findings: Significant relationship between medium and high new COVID cases with anxiety searches. Not significant otherwise.

3. Does the level of COVID-related restrictions in US states have a relationship with depression and anxiety levels?
   Findings: Significant relationship between low and high new COVID cases and medium and high new COVID cases with anxiety Google searches. Not significant otherwise.

Sources of Error and Potential Solutions

Sources of Error:

1. Assuming Google Search Trends as a reflection of reality.
2. Failure to satisfy hypothesis test assumptions.
3. Using a uniformed timeline when states are at different stages of dealing with the pandemic.

Potential Solutions:

1. Considering alternative methods of collecting data on anxiety/depression trends.
2. Using data showing depression/anxiety Google searches per day instead of per week.
3. Increasing the time span of measurement to multiple months .
4. Considering statistical tests that require less assumptions.