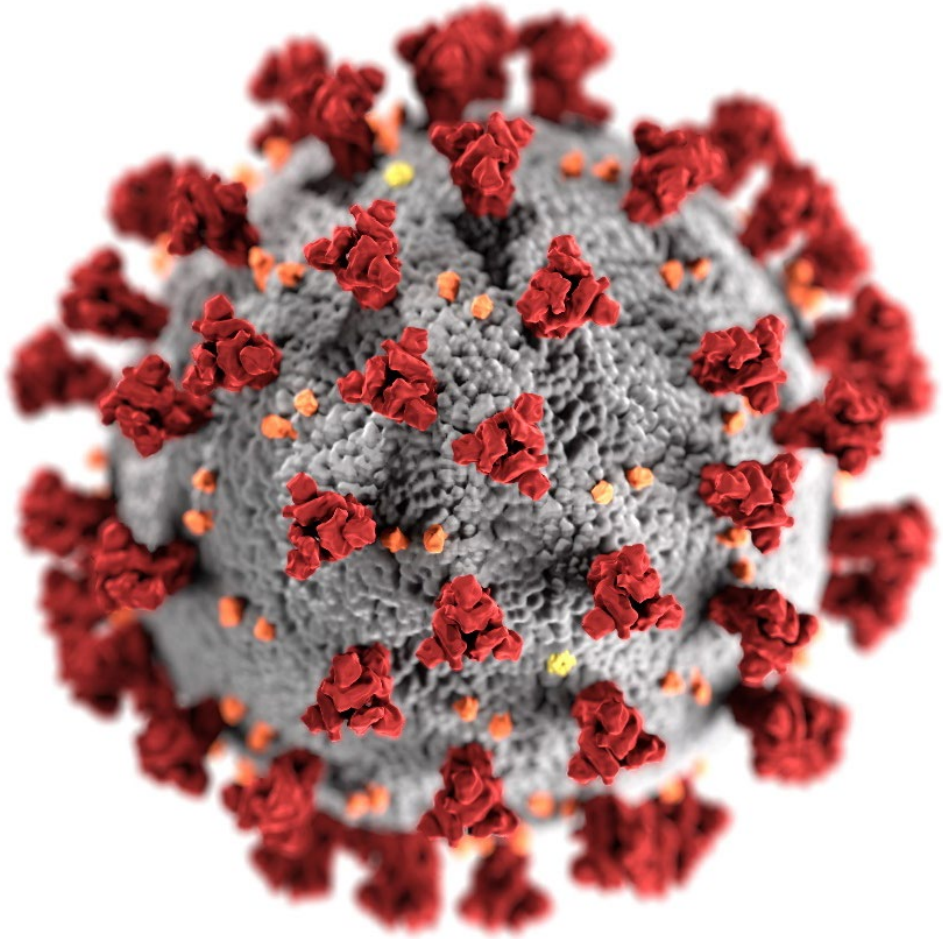
Indicators for Monitoring COVID-19 Community Levels and COVID-19 and Implementing COVID-19 Prevention Strategies

Accessible Version: https://www.cdc.gov/coronavirus/2019-ncov/science/community-levels.html

Overview and Scientific Rationale



February 25, 2022

cdc.gov/coronavirus

Why refocus efforts for monitoring COVID-19 in communities?

- **Shift from eliminating SARS-CoV-2 transmission towards more relevant metrics given current levels of population immunity and tools available**
- **Current high levels of population immunity reduce risk of severe outcomes**
  - High rates of vaccination in population as a whole
  - Availability of boosters, and booster coverage among populations at high risk
  - In unvaccinated, high rates of infection-induced protection
- **Breadth of tools available for public health and clinical care**
  - Broad access to vaccines, therapeutics, testing

- **Community measures should focus on minimizing the impact of severe COVID-19 illness on health and society**
  - Preventing medically significant illness
  - Minimizing burden on the healthcare system
  - Protecting the most vulnerable through vaccines, therapeutics, and COVID-19 prevention

CDC's Indicators of Community Transmission

Indicator	Low Transmission	Moderate Transmission	Substantial Transmission	High Transmission
Total new cases per 100,000 persons in the past 7 days	0-9	10-49	50-99	≥100
Percentage of Nucleic Acid Amplification Test results that are positive during the past 7 days	<5.0%	5.0%-7.9%	8.0%-9.9%	≥10.0%

- First released in September 2020
- Relied on two metrics to define community transmission: Total new cases per 100,000 persons in the past 7 days, and percentage of Nucleic Acid Amplification Test results that are positive during the past 7 days
- Used by CDC to inform setting-specific guidance and layered prevention strategies (e.g., screening testing in schools, masking, etc.)
- Public health practitioners, schools, businesses, and community organizations also rely on these metrics to inform decisions about prevention measures

The current state of the pandemic requires a refined approach to monitoring COVID-19

- Community transmission indicators were developed in fall 2020 (prior to availability of vaccines) and reflect goal of limiting transmission in anticipation of vaccines being available
- **Neither of the community transmission indicators reflects medically significant disease or healthcare strain**
- Community transmission levels are largely driven by case incidence, which does not differentiate mild and severe disease

Criteria for Selecting Community Indicators

- Indicators had to meet several criteria:
    1. Data available at the county level or allocated to county level from health service areas
    2. Data source provides nation-wide coverage
    3. Data reflect intended goals of emphasizing medically significant disease and healthcare strain
    4. Data reported at least weekly (or more often) with sufficient timeliness to allow data to inform decisions about prevention measures

Selecting COVID-19 Community Indicators

- Criteria were established to assess potential candidate indicators
- Review of historical data from 18 months of the pandemic
  - Compiled available indicators across data systems
  - Assessed trends in increases and declines in cases, hospital capacity, other indicators
  - Reviewed historical data and thresholds used in COVID-19 Community Profile Report | HealthData.gov and State Profile Report
- Assessed candidate indicators against criteria and eliminated those that did not fully meet established criteria
  - Deaths, while an important metric, are a lagging indicator and have low numbers which result in unstable estimates at local levels
  - Emergency Department visits from the National Syndromic Surveillance Program are a promising indicator, but include 71% of emergency departments, so do not have national coverage

Final Selection of COVID-19 Community Indicators

- Narrowed the list of candidate indicators based on criteria:
  - *New hospital admissions with confirmed COVID-19/100,000 people* and *percent of inpatient beds occupied with COVID-19 patients* selected as best candidates
  - ICU beds occupied, new hospital admissions/100 beds, test positivity, and metrics reflecting percent change (e.g., in new admissions, new cases) eliminated
  - New cases retained as a potential candidate to assess performance as leading indicator

Establishing Thresholds for COVID-19 Community Levels

- Used correlation analyses and thresholds from Community Profile Reports and State Profile Reports to assess potential thresholds
- Correlations indicate:
  - 100 cases/100,000 population per week corresponds to about 3-4% of COVID-19 inpatient bed utilization, 6-10 new admissions/100,000 population
  - Inpatient bed occupancy is about half that of ICU occupancy
  - Fewer new admissions, fewer admissions per case, and lower inpatient bed utilization in areas with higher vaccination coverage
- Established candidate thresholds, then tested to calibrate levels

Indicator Performance Analysis Results

Question	Answer
What is the appropriate outcome variable?	Deaths, with ICU bed utilization as a secondary indicator. Both are correlated with transmission levels and COVID-19 community levels.
What is the optimal lag between the community level/transmission level and the outcome?	Correlation with death rates for new cases, hospital admissions and bed utilization peaks when the lag is set at 3 weeks.
How do individual indicators such as admissions, inpatient bed utilization predict outcomes?	Individual indicators have moderate correlation with deaths/100k three weeks later (~0.3) at the county level and high correlation (~0.8) at the state level. COVID-19 community levels (county: 0.3, state: 0.7) have **higher** correlations with death rates than transmission levels (county: 0.2, state: 0.5)
Which scheme (transmission levels or COVID-19 community levels) is more useful for identifying regions that will experience severe outcomes?	COVID-19 community levels are a more effective categorization scheme for identifying regions that will experience high death rates 3 weeks later according to multiple metrics (correlation, AUROC).
Should the thresholds be adjusted in response to this analysis?	Adjusting thresholds shifts the balance between levels and more balanced categorizations are more informative. COVID-19 community levels result in more balanced categories/levels.

Do community transmission levels or COVID-19 community levels better predict deaths and ICU utilization in counties?

- Do higher transmission levels and higher COVID-19 community levels correspond to more severe outcomes 3 weeks later?
  - Multiple analyses using different indicator thresholds were conducted to optimize the levels. COVID-19 community levels provided consistently better prediction compared with community transmission.
  - Analyses used AUROC (area under receiver operating characteristic). This can be interpreted as the probability that given two randomly selected observations from different levels, the one with the more severe outcome comes from a higher transmission/COVID-19 community level. Data analyzed included historical data from March 2021-January 2022
  - A score of 0.5 would correspond to random guessing and a score of 1 would indicate that worse outcomes always correspond to higher COVID-19 community levels/transmission levels.
- COVID-19 community levels are better predictors of deaths and ICU utilization 3 weeks later than community transmission levels at the county level.
  - Analyses using AUROC, Spearman's correlation, and Pearson's correlation coefficient provide consistent results.
  - Analyses used 4-level schemes for COVID-19 community levels and then were pared down to 3 levels based on end-user feedback.

Indicator Thresholds were Further Refined

- Compared different combinations of thresholds
  - With/without case threshold, and with different case thresholds (100, 200, 500, 1000 cases/100,000/week)
  - Different levels of *new COVID-19 hospital admissions* and *inpatient beds occupied by COVID-19 patients*
- Optimized levels based on thresholds with consistently higher performance at predicting ICU bed utilization, deaths, new admissions, and inpatient bed use 3 weeks later

CDC's COVID-19 Community Levels and Indicators

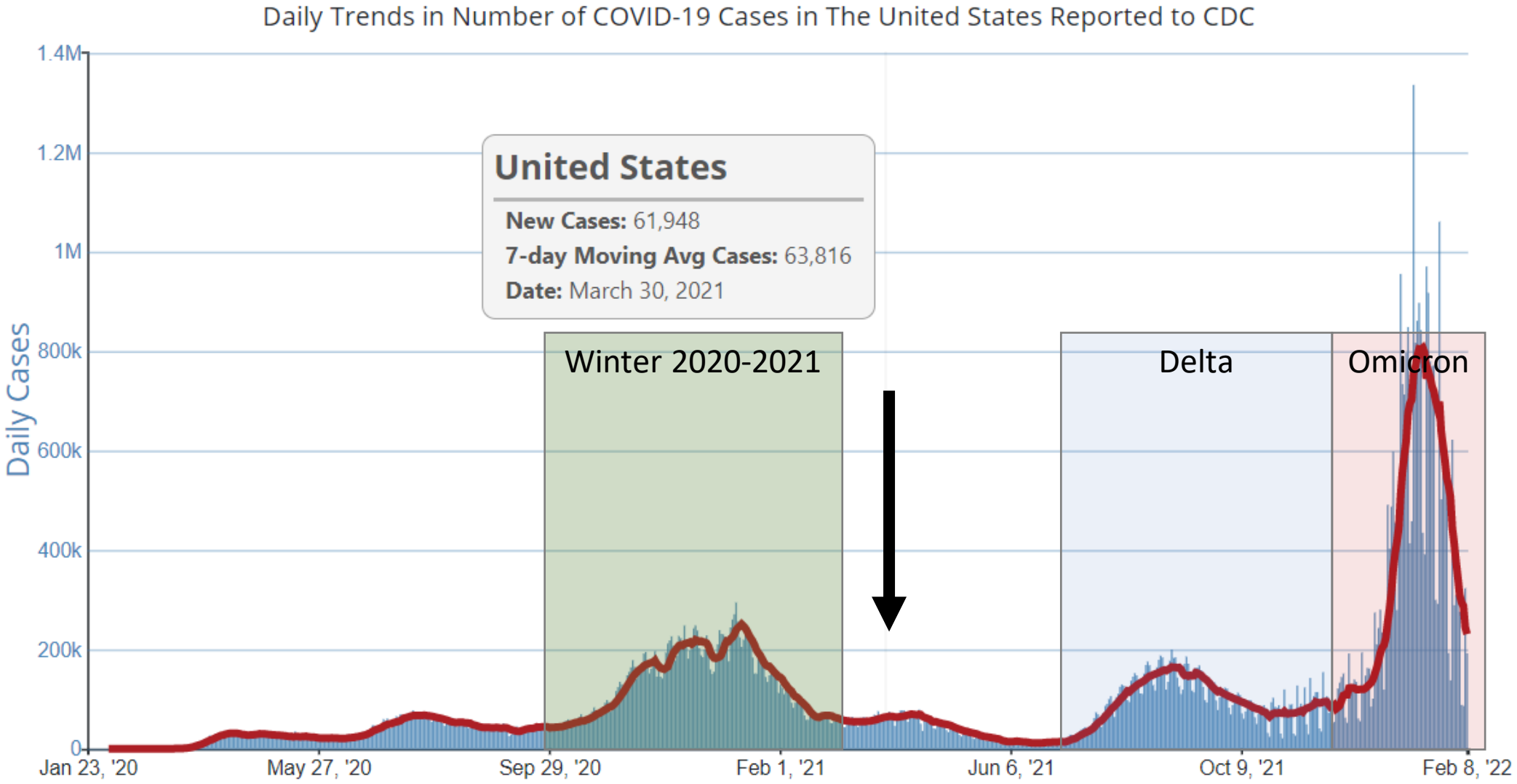
New Cases (per 100,000 population in the last 7 days)	Indicators	Low	Medium	High
Fewer than 200	New COVID-19 admissions per 100,000 population (7-day total)	<10.0	10.0-19.9	≥20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	<10.0%	10.0-14.9%	≥15.0%
200 or more	New COVID-19 admissions per 100,000 population (7-day total)	NA	<10.0	≥10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	NA	<10.0%	≥10.0%

The COVID-19 community level is determined by the higher of the inpatient beds and new admissions indicators, based on the current level of new cases per 100,000 population in the past 7 days

COVID-19 community levels are better predictors of deaths and ICU utilization in communities

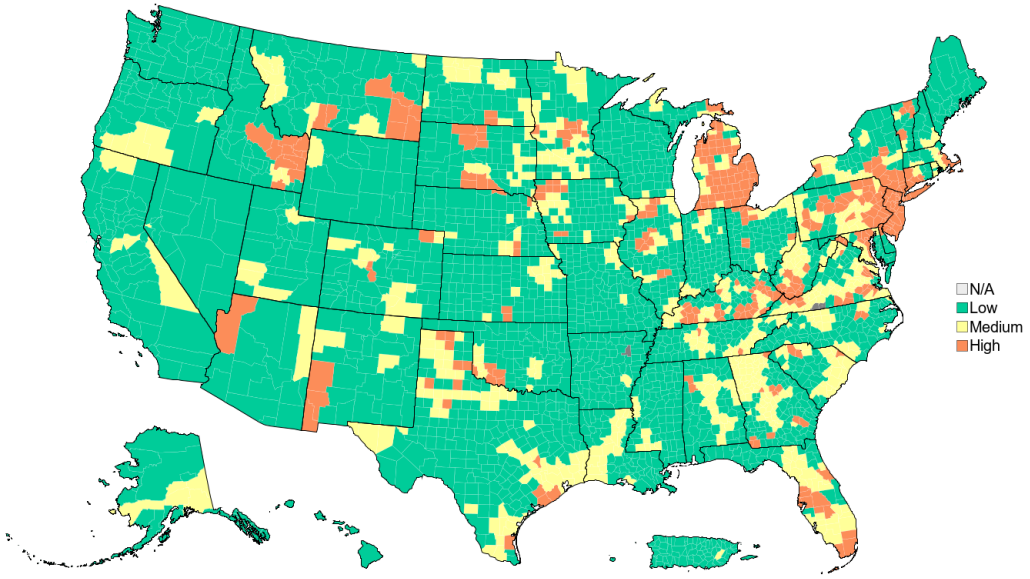
- The proposed COVID-19 community levels provide a **sizeable improvement** over the community transmission levels in identifying regions that will experience severe outcomes 3 weeks later
  - To prevent deaths and ICU bed use, COVID-19 community levels using new indicator metrics provide more robust measures
  - COVID-19 community levels result in more meaningful differences between categories

COVID-19 community levels on March 30, 2021 (post Alpha)



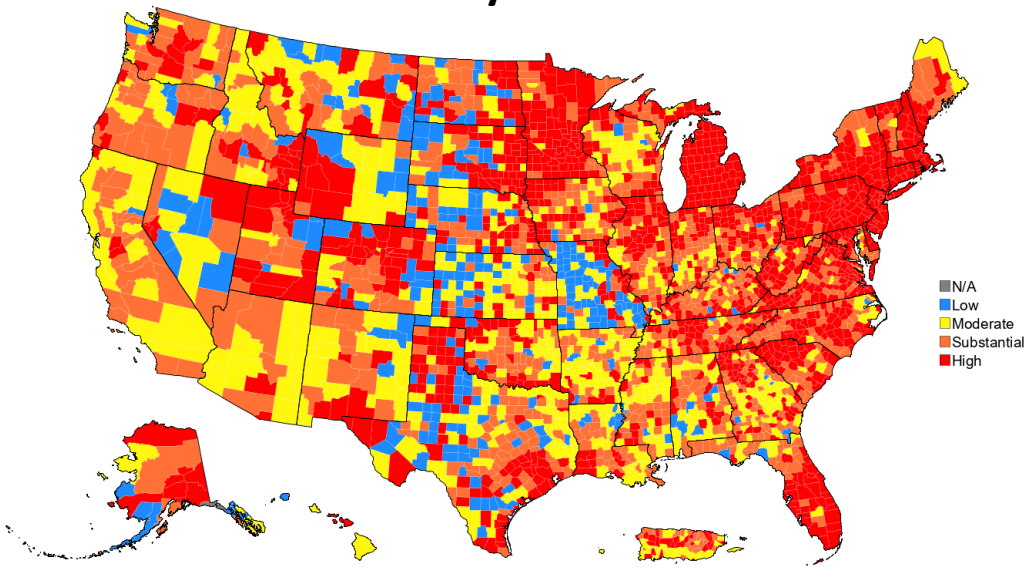
COVID-19 Community Levels on March 30, 2021

COVID-19 Community Level



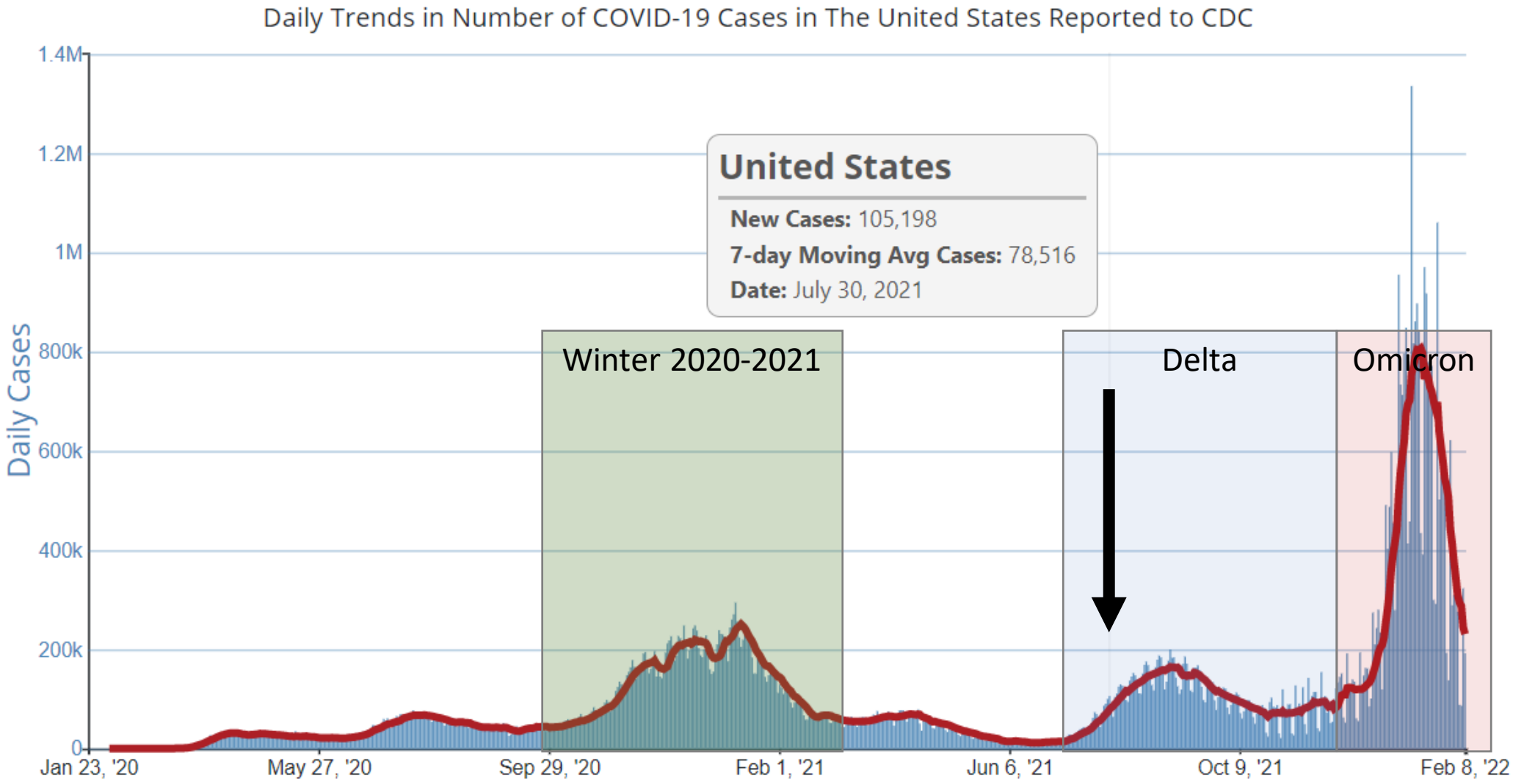
	% of Counties	% of Pop.
Low	67.3%	56.9%
Medium	22.0%	23.4%
High	10.6%	19.7%

Community Transmission



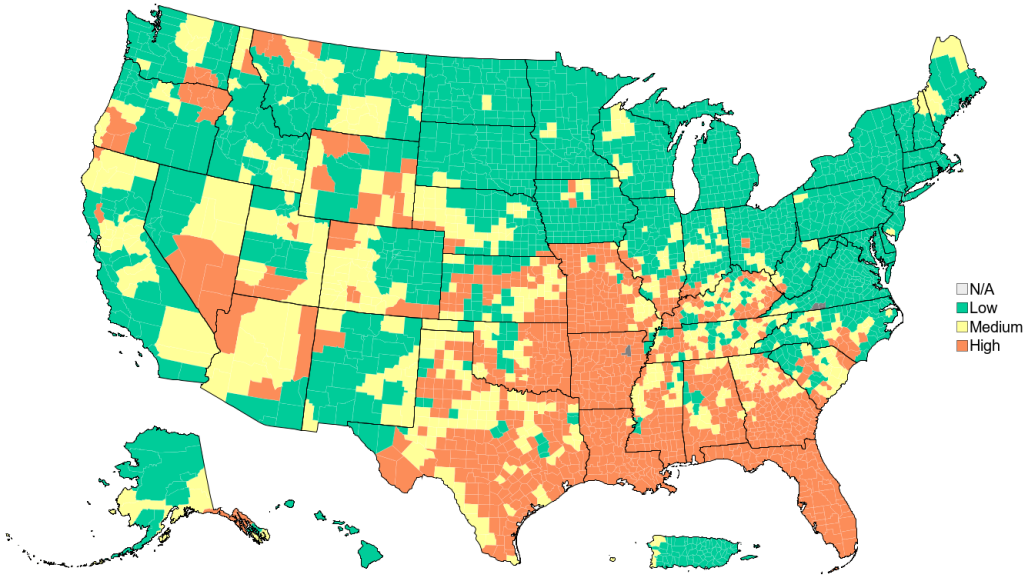
	% of Counties	% of Pop.
Low	9.3%	1.4%
Moderate	22.0%	17.3%
Subst.	28.3%	26.4%
High	40.5%	54.9%

COVID-19 community levels on July 30, 2021 (rise of Delta)



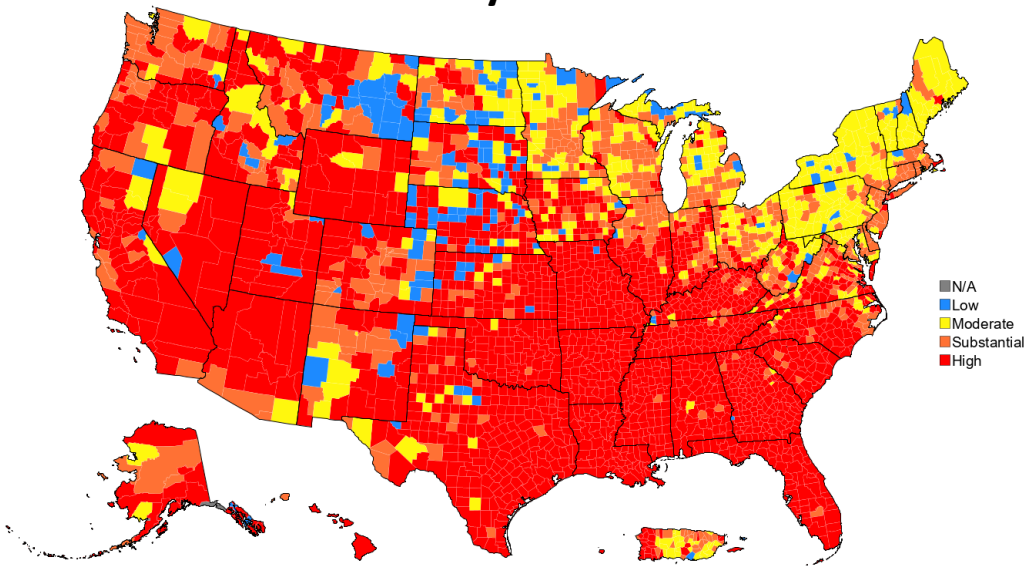
COVID-19 Community Levels on July 30, 2021

COVID-19 Community Level



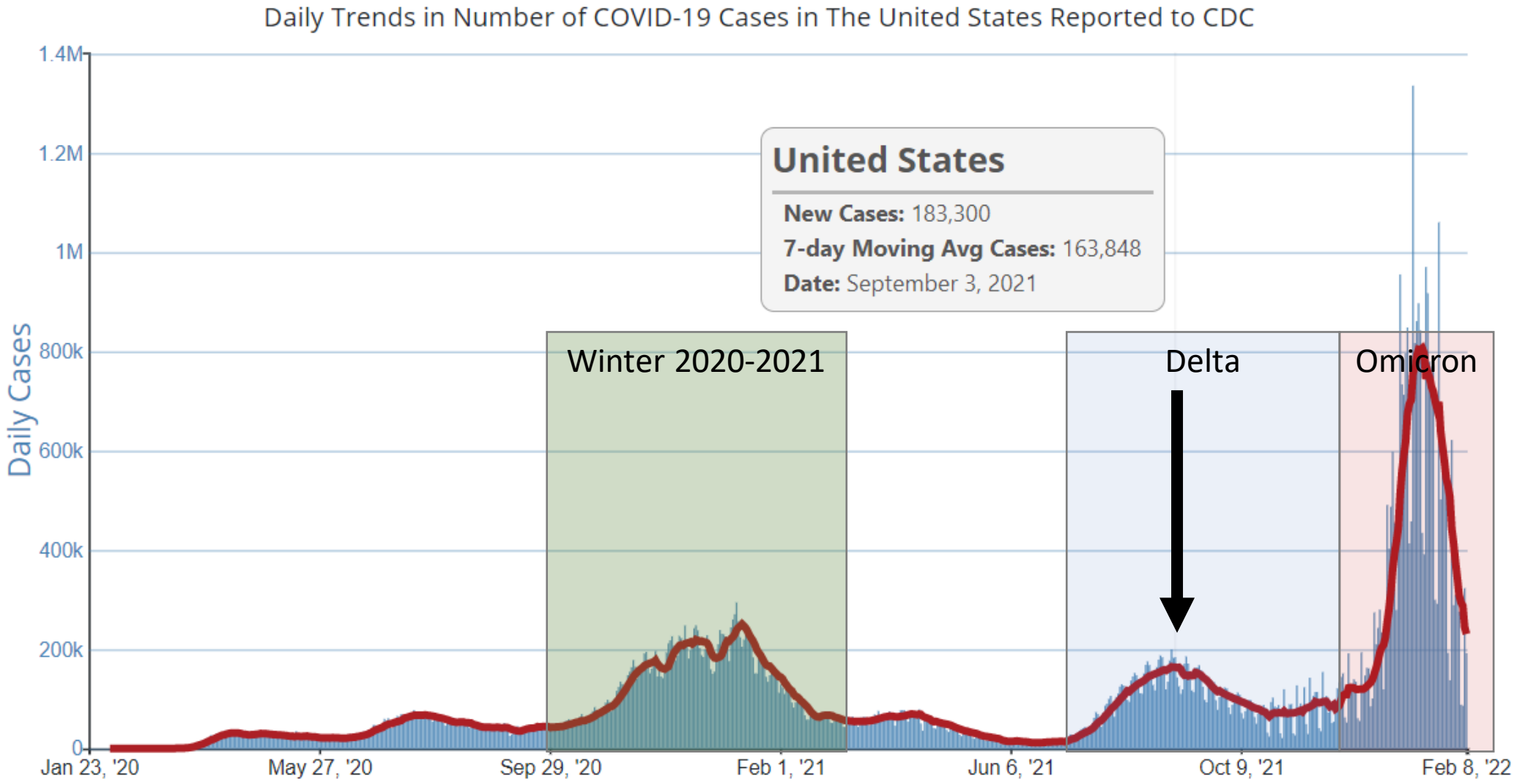
	% of Counties	% of Pop.
Low	49.6%	57.7%
Medium	20.2%	18.3%
High	30.1%	23.9%

Community Transmission



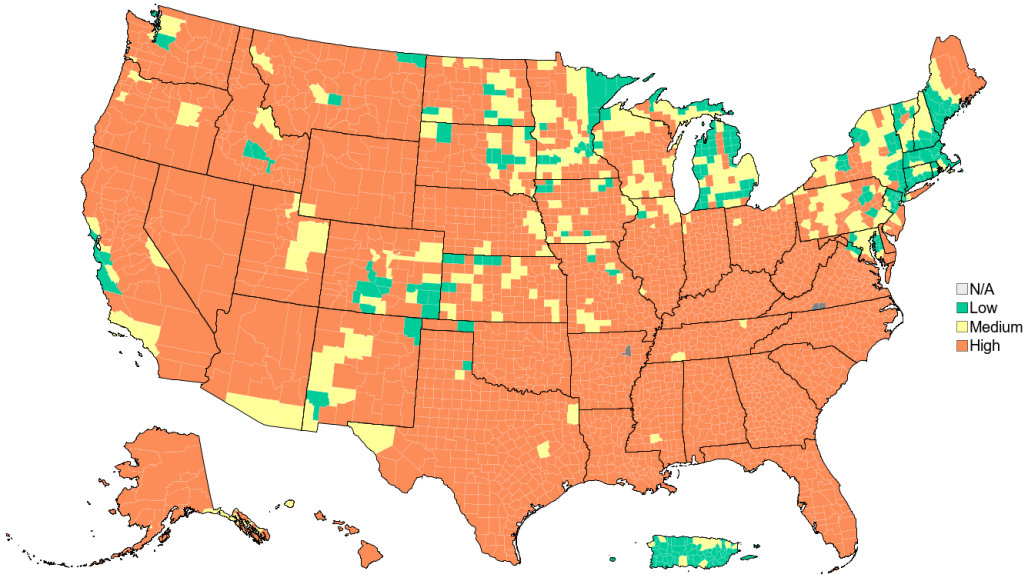
	% of Counties	% of Pop.
Low	4.8%	0.4%
Moderate	15.7%	12.1%
Subst.	18.2%	28.0%
High	61.3%	59.4%

COVID-19 community levels on September 3, 2021 (peak of Delta)



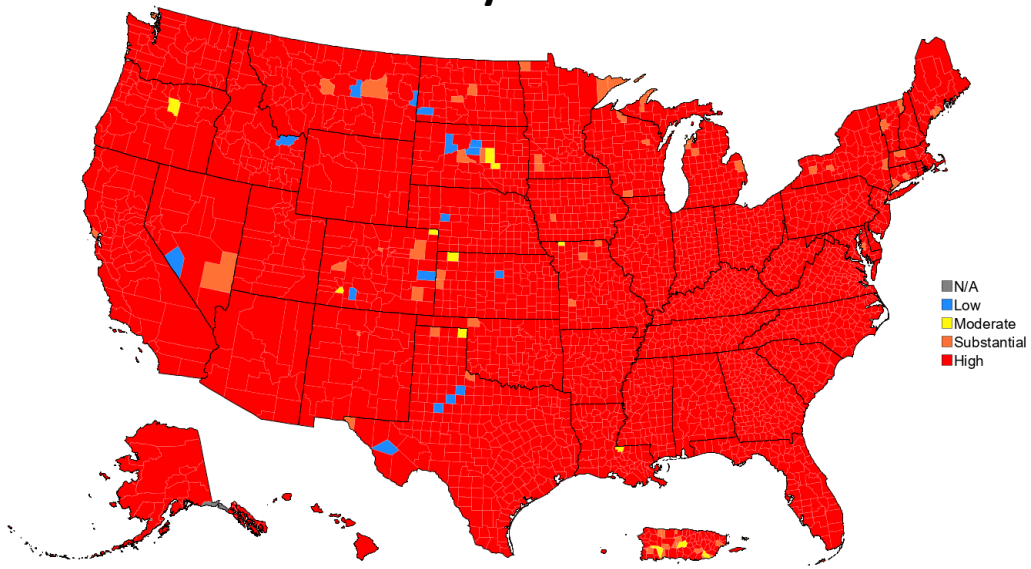
COVID-19 Community Levels on September 3, 2021

COVID-19 Community Level



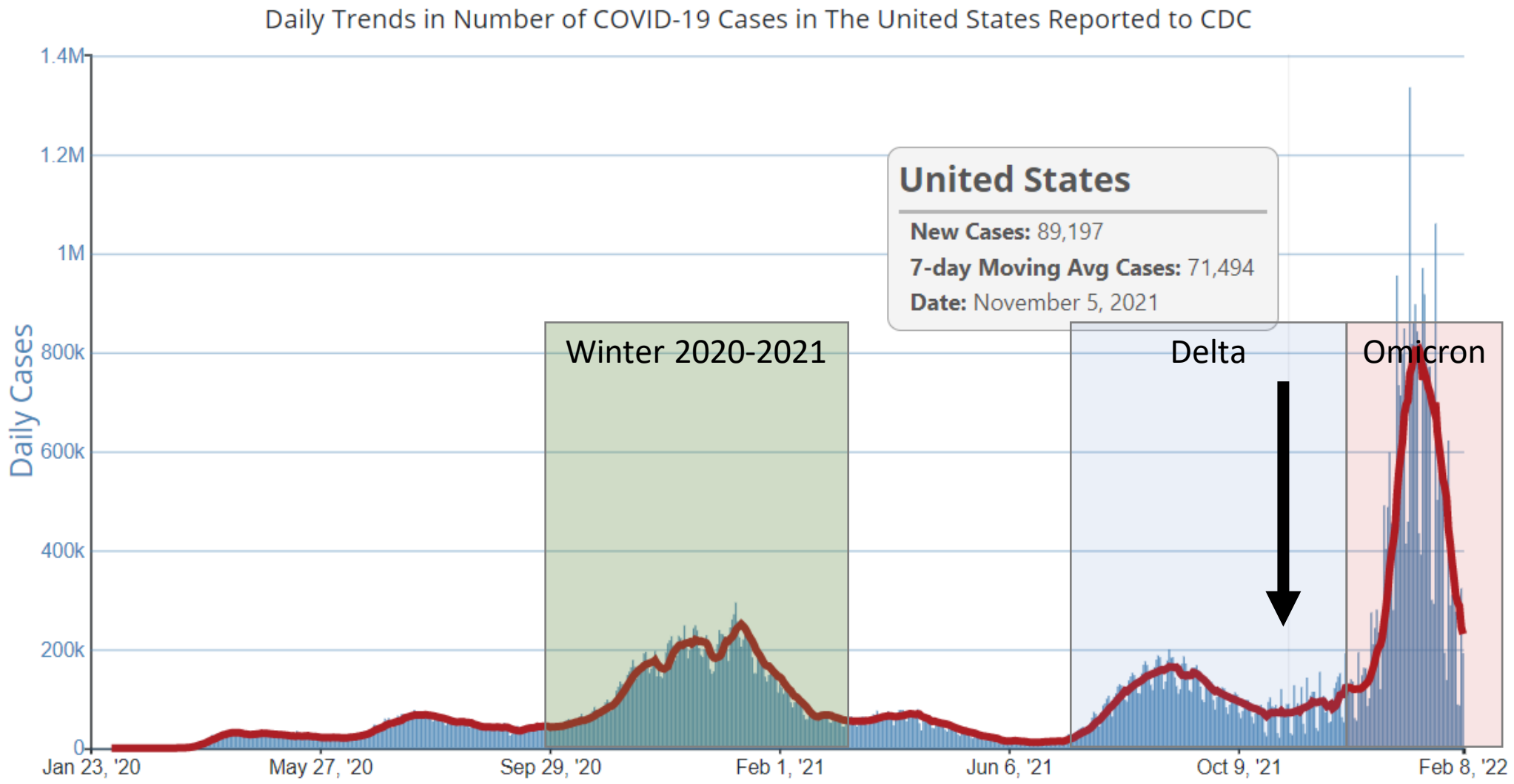
	% of Counties	% of Pop.
Low	8.1%	14.9%
Medium	12.2%	20.5%
High	79.6%	64.7%

Community Transmission



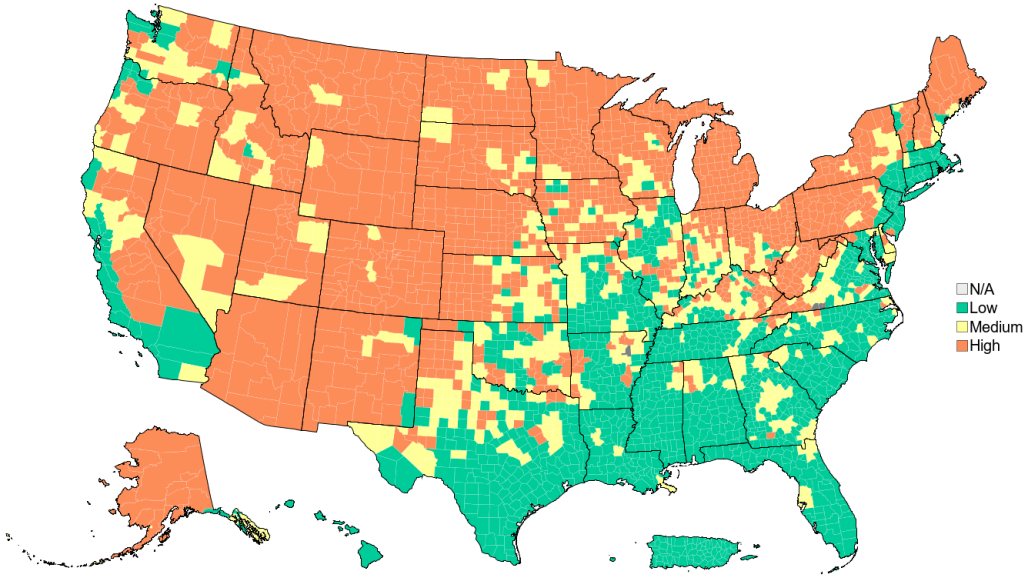
	% of Counties	% of Pop.
Low	0.5%	0.0%
Moderate	0.4%	0.0%
Subst.	2.0%	1.2%
High	97.0%	98.8%

COVID-19 community levels on November 5, 2021 (between Delta and Omicron)



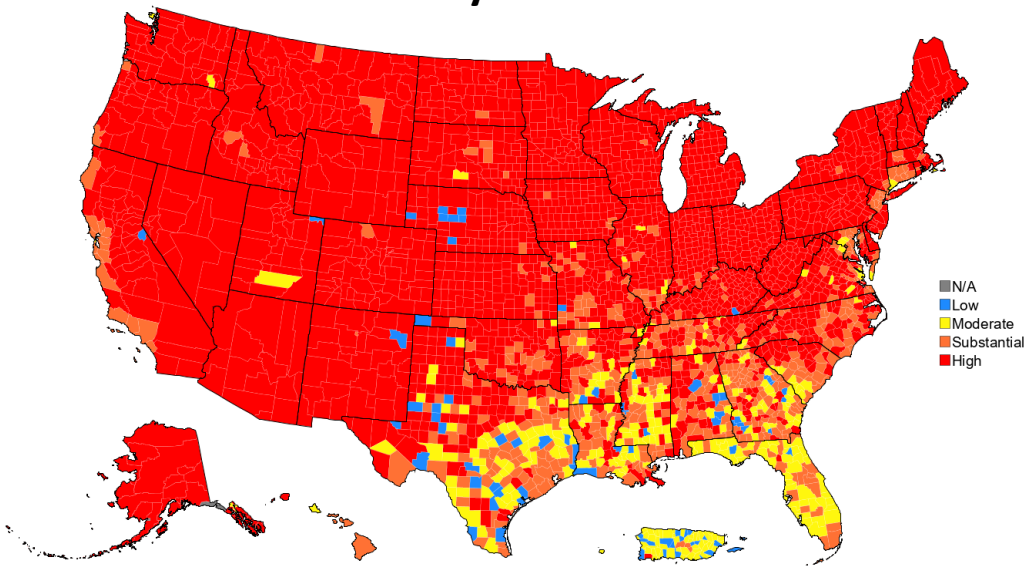
COVID-19 Community Levels on November 5, 2021

COVID-19 Community Level



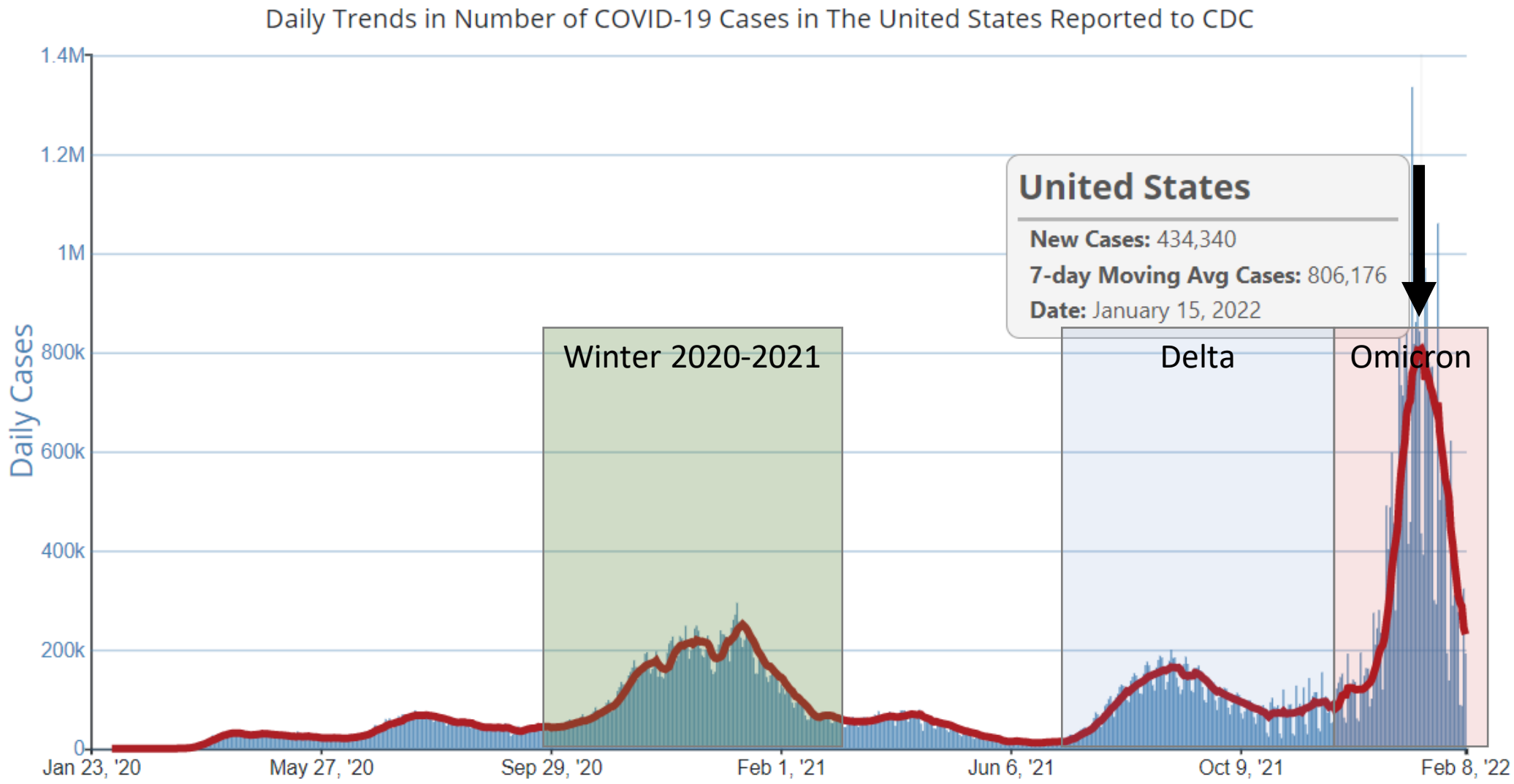
	% of Counties	% of Pop.
Low	38.3%	58.5%
Medium	21.5%	16.5%
High	40.1%	25.0%

Community Transmission



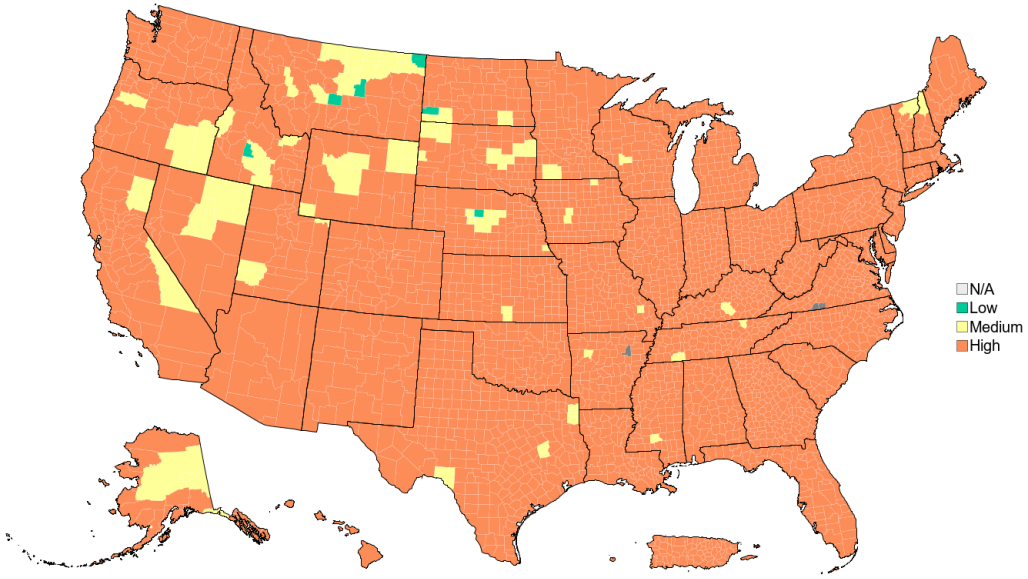
	% of Counties	% of Pop.
Low	2.6%	0.6%
Moderate	9.4%	8.6%
Subst.	16.8%	32.5%
High	71.2%	58.2%

COVID-19 community levels on January 15, 2022 (peak of Omicron)



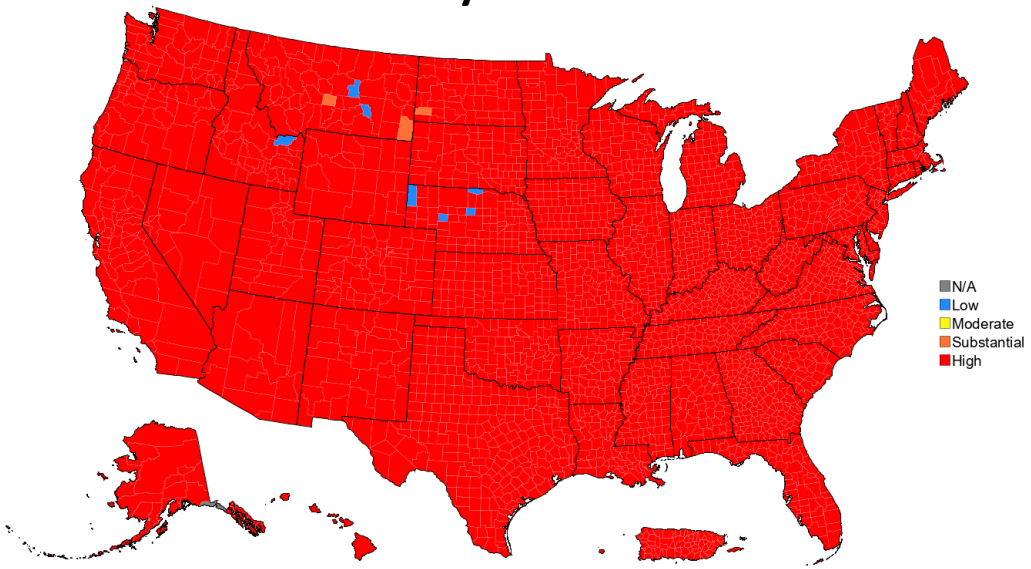
COVID-19 Community Levels on January 15, 2022

COVID-19 Community Level



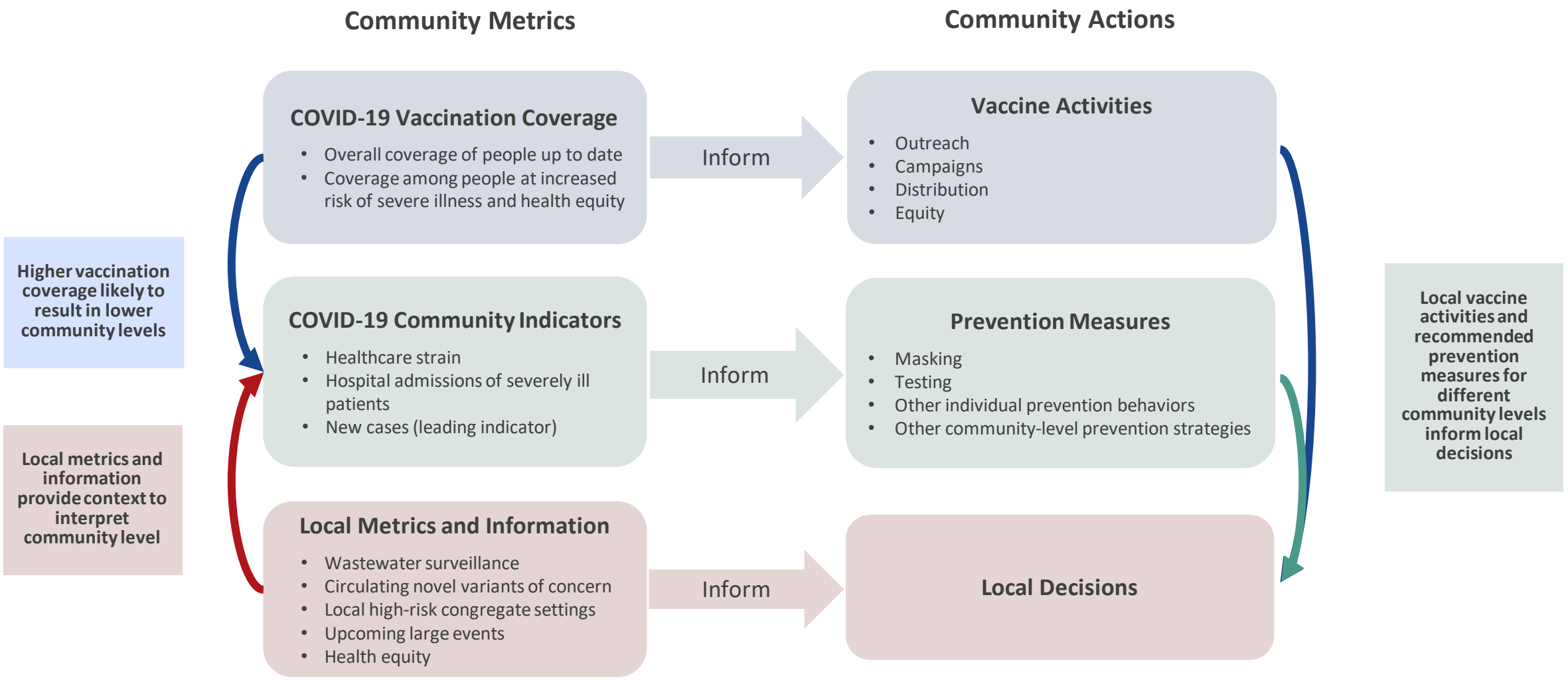
	% of Counties	% of Pop.
Low	0.2%	0.0%
Medium	3.2%	0.5%
High	96.5%	99.5%

Community Transmission



	% of Counties	% of Pop.
Low	0.3%	0.0%
Moderate	0.0%	0.0%
Subst.	0.1%	0.0%
High	99.6%	100.0%

Proposed Framework for Monitoring and Prevention



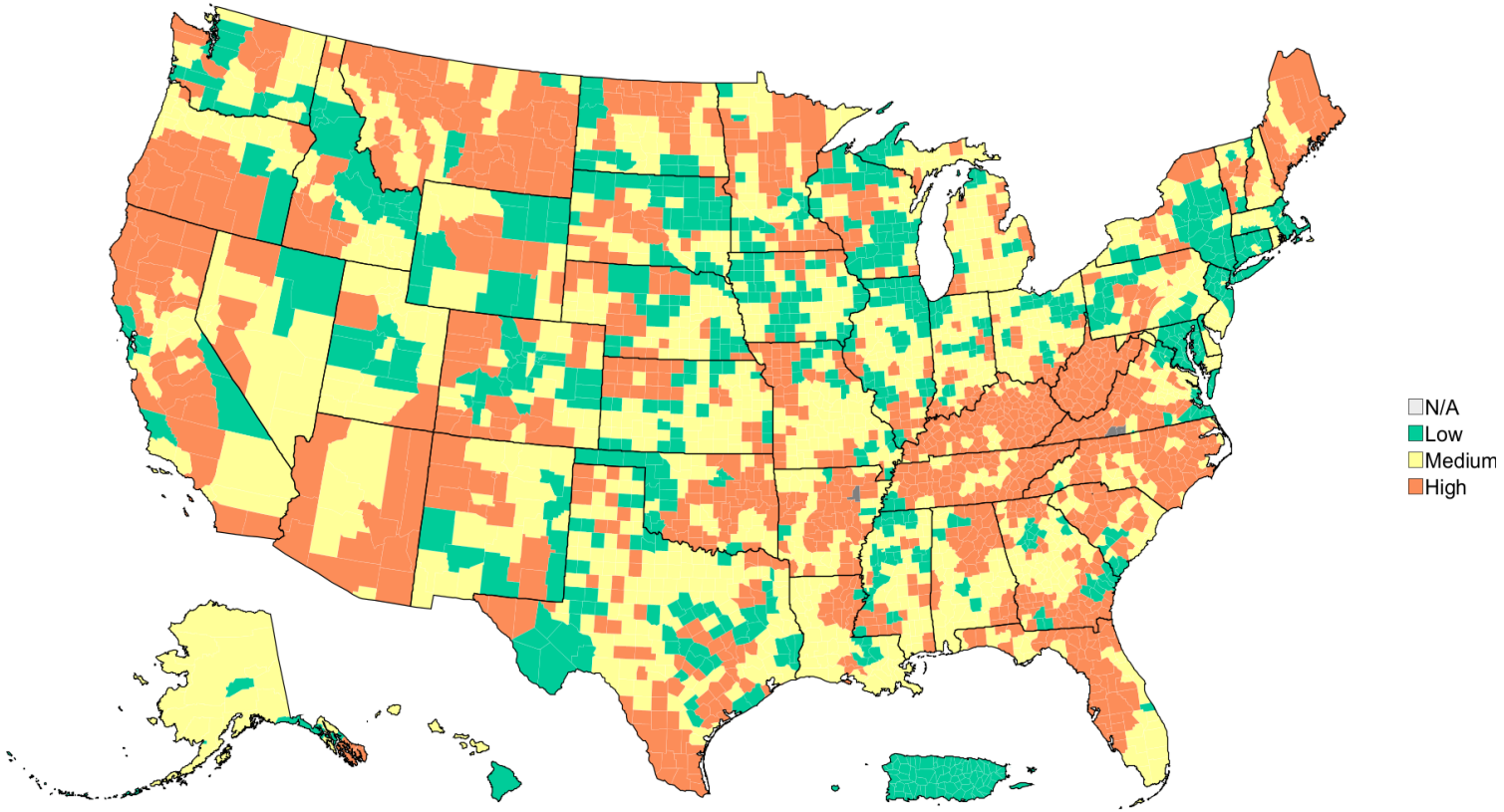
Implications for Using COVID-19 Community Levels to Inform Public Health Recommendations

- COVID-19 community levels can inform recommendations for **community-level preventive strategies** and **individual preventive behaviors**
- At higher COVID-19 community levels recommendation would include:
  - Masking
  - Testing Strategies (e.g., screening testing)
  - High-risk individuals and their household or social contacts (e.g., masking, testing, and access to treatments)
  - Setting-specific recommendations (e.g., K-12 schools, healthcare)
  - High-risk congregate settings (e.g., masking and screening testing)

Key Considerations

- Vaccination is the leading public health prevention strategy to prevent severe disease and deaths from COVID-19.
- People who are up to date on vaccines have much lower risk of severe illness and death from COVID-19 compared with unvaccinated people.
- When making decisions about individual preventive behaviors and community prevention strategies in addition to vaccination, people and health officials should consider the COVID-19 community level.
- Health departments should consider health equity, and make use of other surveillance information (wastewater, ED surveillance, etc.), if available, to inform local decisions.
- Layered prevention strategies — like staying up to date on vaccines and wearing masks — can help prevent severe disease and reduce strain on the healthcare system.

COVID-19 community levels on February 24, 2022



	% of Counties	% of Pop.
Low	23.0%	29.5%
Medium	39.6%	42.2%
High	37.3%	28.2%

Data sources and acknowledgments

- **Data sources**
  - Unified Hospital Data Surveillance System (UHDSS)
  - Aggregate Case and Death Counts (ACDC)
- **Acknowledgments**
  - Johns Hopkins University's Applied Physics Laboratory
  - CDC COVID-19 Response