Science Brief: Indicators for Monitoring COVID-19 Community Levels and Making Public Health Recommendations

Updated Aug. 12, 2022

COVID-19 Science Briefs provide a summary of the scientific evidence used to inform specific CDC guidance and recommendations. The Science Briefs reflect the scientific evidence, and CDC's understanding of it, on a specific topic at the time of the Brief's publication. Though CDC seeks to update Science Briefs when and as appropriate, given ongoing changes in scientific evidence an individual Science Brief might not reflect CDC's current understanding of that topic. As scientific evidence and available information on COVID-19 change, Science Briefs will be systematically archived as historic reference materials.

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Summary of Recent Changes

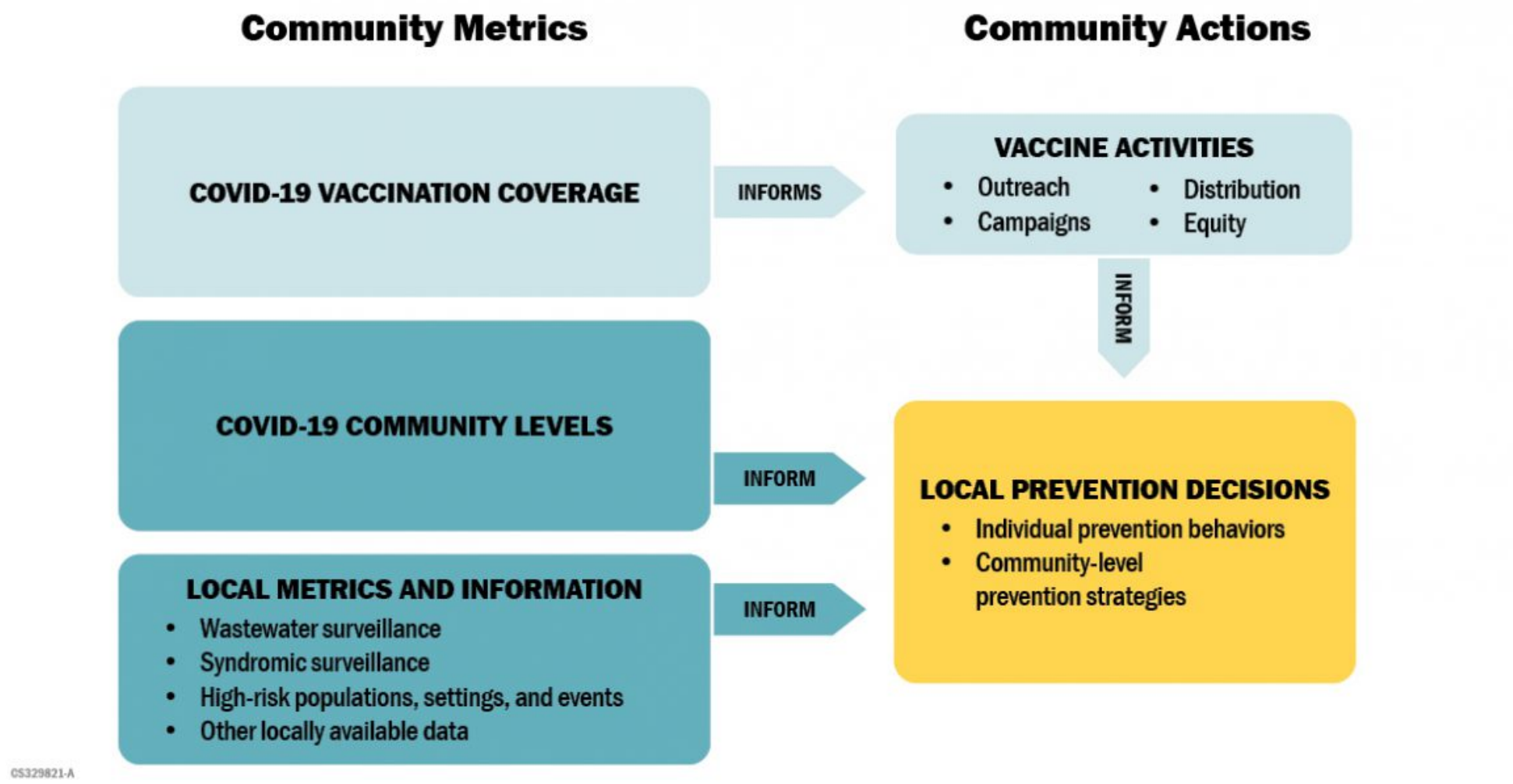
Updates as of August 11, 2022

- Updated recommendations table to align with updates to webpages and guidance.
- Revised individual- and household-level prevention behaviors and community-level prevention strategies for low, medium and high COVID-19 community levels.

Background

Widespread uptake of COVID-19 vaccines that are highly effective against severe illness and death,[1-4] the accrual of high rates of vaccine- and infection-induced immunity at the population level,[5-7] and the availability of effective therapeutics[8] have moved the pandemic to a different phase. Despite high volume of hospitalizations due to high caseloads, the emergence of Omicron as the dominant variant reflected lower virulence and disease severity.[29] These changes make it more feasible to minimize medically significant disease and prevent excessive strain on the healthcare sector, even in the occurrence of SARS-CoV-2 transmission. A burdened healthcare system is associated with increased mortality associated with COVID-19[9-10] and limits capacity and resources for medical care for non-COVID-19 conditions.[10-11] Accordingly, at this stage of the pandemic, data on disease severity and healthcare system strain to complement case rates are more informative for public health recommendations for individual, organizational, and jurisdictional decisions than data on community transmission rates alone. A comprehensive approach to assessing COVID-19 community levels can inform decisions about layered COVID-19 prevention strategies (Figure 1), including vaccination and masking, with explicit goals of reducing medically significant disease and limiting strain on the healthcare system.

Figure 1. How community metrics and actions should inform the prevention decisions of local authorities



Starting in September 2020, CDC recommended the use of two metrics to assess the level of community transmission: new COVID-19 cases per 100,000 persons in the last 7 days and percent of SARS-CoV-2 diagnostic nucleic acid amplification tests (NAATs) in the last 7 days that were positive.[12] These indicators of community transmission were used to inform mask recommendations[13] and setting-specific guidance such as screening tests in schools and alert the public to community transmission levels.[14] Public health practitioners, schools, workplaces, businesses, and community organizations also relied on these metrics to inform decisions about other preventive measures.

However, neither of these metrics directly reflects the risk of medically significant disease or healthcare system strain. With high levels of population immunity from vaccines or prior infection,[5-7] breakthrough cases and reinfections more frequently result in asymptomatic infections or milder illness in most persons.[2,6,15] Consequently, measures of community transmission provide different information in the context of high population protection compared to previous points in the pandemic with lower vaccination coverage and fewer people with prior infection. To inform prevention measures that aim to minimize severe illness and healthcare strain, CDC recommends that public health officials monitor COVID-19 Community Levels.

What is the difference between Community Transmission and COVID-19 Community Levels? Community Transmission refers to measures of the presence and spread of SARS-CoV-2, the virus that causes COVID-19. COVID-19 Community Levels refer to the measures of the impact of COVID-19 in terms of hospitalizations and healthcare system strain, while accounting for transmission in the community.

COVID-19 Community Level Indicators

CDC recommends the use of three indicators to measure COVID-19 Community Levels: (1) *new COVID-19 hospital admissions per 100,000 population in the last 7 days;* (2) *percent of staffed inpatient beds occupied by patients with confirmed COVID-19 (7-day average);* and (3) *new COVID-19 cases per 100,000 population in the last 7 days* (Table 1).

TABLE 1. COVID-19 Community Levels, Indicators, and Thresholds

New COVID-19 Cases New COVID-19 Cases Per 100,000 people in the past 7 days Per 100,000 people in the past 7 days	Indicators Indicators	Low Low	Medium Medium	High 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 *new admissions* and *inpatient beds occupied* metrics, based on the current level of *new cases per 100,000 population in the past 7 days*.

[1] Number of new cases in the county in the past 7 days divided by the population in the county (or other administrative level) multiplied by 100,000.

[2] Total number of new admissions of patients with confirmed COVID-19 in the past 7 days divided by the total population in the Health Service Area, multiplied by 100,000.

[3] Percent of staffed inpatient beds that are occupied by patients with confirmed COVID-19 within the entire Health Service Area (7-day average).

The number of *new hospital admissions of patients with COVID-19 per 100,000 population* reflects the amount of severe COVID-19 disease within the community. *Percent of staffed inpatient beds occupied by patients with COVID-19* is an indicator of local healthcare system usage and remaining capacity. Regardless of the reason for inpatient care, the level of usage of clinical care resources to manage patients with COVID-19 reflects impact on the community and signals when urgent implementation of layered prevention strategies might be necessary to prevent overloading the healthcare system. These indicators are proxies for underlying COVID-19 morbidity and severity of COVID-19 cases, and for the ability of the local healthcare system to support additional people requiring hospital care, including those with COVID-19. In addition, *new COVID-19 cases per 100,000 population in the past 7 days* serves as a leading indicator – most importantly early in a surge — of anticipated healthcare strain.

The indicators combine to result in three COVID-19 Community Levels: low, medium, and high. The COVID-19 Community Level is determined by the higher of the *new COVID-19 hospital admissions* and *percent inpatient beds occupied by patients with COVID-19* indicators and is adjusted upwards one level if the new COVID-19 cases indicator is ≥ 200 cases per 100,000 population in the last 7 days.

A rapid rise in new cases may forecast increases in new hospitalizations or inpatient beds occupied by COVID-19 patients. Monitoring this leading indicator can allow communities to plan appropriately. When COVID-19 Community Levels are low, it does not indicate that virus is not circulating, or that individuals do not need to take any preventive measures to protect themselves, especially if they are at high-risk for serious disease. As communities see declines in case rates and the burden on the healthcare system eases, this can signal to individuals and communities when to discontinue the use of some layered prevention strategies. Community members can likewise consider these factors in making decisions about individual prevention behaviors based on their level of risk for severe disease or that of the members of their household or contacts.[16]

How the indicators of COVID-19 community levels were selected

To identify indicators, criteria were established that reflected priorities for indicator representation.

1. All indicators should have available county-level metrics from either data reported at the county level or allocated to county level from Health Service Areas (HSAs).
2. All indicators should have coverage from all counties in the United States (or with the possibility of allocation to all counties using HSAs).
3. Indicators should directly reflect the intended goals of minimizing medically significant disease or healthcare strain or represent a leading indicator of potential increases in severe disease or healthcare strain.
4. Indicators must represent data reported at least weekly or more often, with sufficient timeliness to permit assessment of COVID-19 Community Levels and use those data to inform decisions about recommended prevention measures in a timely manner.

Based on these criteria, a comprehensive review of historical data and available indicators, including reviews of existing data sources, data systems, and metrics, was conducted. This included an inventory of available indicators and data sources with frequent reporting and displays on CDC COVID Data Tracker. Candidate indicators were compiled that included all available data systems and sources. Historical data and thresholds used in the COVID-19 Community Profile Report and the State Profile Report were reviewed. These two reports provide daily metrics based on established thresholds reflecting trend data at the state and county level. Finally, a review of historical trends in increases and declines in cases, hospital metrics, and other data was conducted. Each candidate indicator on the comprehensive list of indicators was assessed against the pre-established criteria, and those that did not fully meet all criteria were eliminated. For example, death rates provide important information for monitoring the impact of COVID-19 at local, state, and national levels. Nonetheless, they are a lagging indicator and occur in very small numbers when reported frequently, particularly in sparsely populated areas. For this reason, death rates were eliminated from the list of potential indicators but retained as a potential outcome to assess the performance of selected community metrics.

Syndromic surveillance, based on the percent of emergency department visits due to COVID-19 (from the National Syndromic Surveillance Program) serves as an early warning system and holds promise in providing community metrics. However, this data source only reflects 71% coverage of emergency departments in the United States, and thus was not included. Counties and states with access to these data may consider these metrics as an additional, optional indicator when determining COVID-19 community level. When this metric is available, jurisdictions could use thresholds of <4.0%, 4.0-5.9%, and ≥6.0% of emergency department visits with diagnosed COVID-19 (7-day average) for communities with <200 new cases per 100,000 population in the past 7 days, and <4.0% and ≥4.0% for communities with ≥200 new cases per 100,000 population in the past 7 days. If including emergency department visits as an additional metric, communities would use the highest of the three indicators (*percent inpatient beds occupied by patients with COVID-19*, *new COVID-19 hospital admissions*, or *percent emergency department visits due to COVID-19*).

Wastewater surveillance complements traditional surveillance and enables health departments to intervene earlier to focused support communities experiencing increasing concentrations of SARS-CoV-2 in wastewater. Robust, sustainable implementation of wastewater surveillance requires public health capacity for wastewater testing, analysis, and interpretation. Wastewater surveillance is a valuable tool that health departments have used to allocate testing resources and forecast resource needs at the community level. Wastewater surveillance represents innovative data for local jurisdictions to use to inform and interpret COVID-19 Community Levels. Because wastewater surveillance does not provide national coverage, it was not considered a critical indicator for COVID-19 Community Levels.

Candidate indicators were further refined based on additional considerations. *Percent of ICU beds occupied with COVID-19 patients* was eliminated due to limitations of data from rural hospitals, the fact that it is a lagging indicator of severe disease, and the potential for bias due to small numbers. *New COVID-19 hospital admissions with confirmed COVID-19 per 100 staffed beds* did not provide added value as the concepts were already represented in other metrics (*new COVID-19 hospital admissions per 100,000 population* and *percent of inpatient beds occupied by COVID-19 patients*). *Test positivity* has limited current utility due to the widespread use of point-of-care and at-home tests, and thus was eliminated. Metrics that reflect percent change (e.g., in *new hospital admissions* or *new cases*) were eliminated due to challenges with interpretability of this metric for lay audiences.

Following this thorough review, *new hospital admissions with confirmed COVID-19 per 100,000 population in the past 7 days* and *percent of staffed inpatient beds occupied by patients with confirmed COVID-19* were retained as "best candidate" indicators. *New cases per 100,000 population in the past 7 days* was also retained to assess performance as a leading indicator.

Data sources

Data sources

The recommended COVID-19 Community Levels leverage the U.S. Department of Health and Human Services Unified Hospital Data Surveillance System (UHDSS), which monitors national and local trends in healthcare system stress, capacity, and community disease levels for approximately 6,000 hospitals in the United States. Data reported by hospitals to UHDSS represent aggregated counts, and include metrics capturing information specific to hospital capacity, occupancy, hospitalizations, and admissions. Most hospitals are required to report daily to UHDSS (with data backdated if reporting is delayed on weekends or holidays). For full guidance on hospital reporting and a list of data elements and definitions, including those used for the COVID-19 Community Level indicators, please visit: https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdf .

Hospital-based metric calculations for COVID-19 Community Level indicators

1. *New admissions of patients with confirmed COVID-19 per 100,000 population (7-day total)*
    - **Numerator**: the total number of patients admitted with laboratory-confirmed COVID-19 to an adult or pediatric inpatient bed each day during the previous 7 days for the specified geographic locality.
    - **Denominator**: total U.S. Census population for the specified geographic locality (based on 2019 Census population estimates).
    - **Missing data**: if there are no data reported for a locality for the given 7-day window, the indicator reported is “N/A.”
2. *Percent of staffed inpatient beds occupied by patients with confirmed COVID-19 (7-day average)*
    - **Numerator**: the average number of adult and pediatric patients hospitalized with laboratory-confirmed COVID-19 each day during the previous 7 days for the specified geographic locality, calculated as the average of valid values within the 7-day period (e.g., if only three valid values, the average of those three is taken).
    - **Denominator**: the average number of staffed inpatient beds during the previous 7 days for the specified geographic locality, calculated as the average of valid values within the 7-day period (e.g., if only three valid values, the average of those three is taken). Per UHDSS reporting guidance, staffed inpatient beds in a facility are defined as those that are currently set up, staffed, and able to be used for a patient within the reporting period. This includes all overflow, observation, and active surge/expansion beds used for inpatients, ICU beds, surge/hallway/overflow beds that are open for use for a patient, regardless of whether they are occupied or available.
    - **Missing data**: if there are no data in the locality for the given 7-day window, the indicator reported is “N/A.”

These metrics are calculated for all hospital subtypes reporting to UHDSS (including Veterans Administration, Defense Health Agency, and Indian Health Service hospitals), excluding psychiatric, rehabilitation, and religious non-medical hospitals.

The data include new COVID-19 hospital admissions and inpatient beds occupied by patients with confirmed COVID-19. Universal screening for SARS-CoV-2 infection continues to be common practice in clinical care, and incidental infections are common in many healthcare settings. The UHDSS data do not distinguish incidental infections from COVID-19-related hospitalizations. Confirmed SARS-CoV-2 infection could be a contributing factor to a health condition in varying ways that are not immediately clear. Further, infection can create burden on the healthcare system, regardless of whether it is the determining factor in hospitalization. All patients with SARS-CoV-2 infection in the hospital pose a risk to healthcare workers and other patients, even if the patient has mild illness or is asymptomatic and the infection is incidental. In addition, having SARS-CoV-2 infection requires isolation and other precautions that place added burden on the healthcare system. Furthermore, SARS-CoV-2 infection may complicate treatment and clinical course of other health conditions, further contributing to health system burden and severe illness.

The data on inpatient bed utilization include the total number of all staffed inpatient beds in the facility, that are currently set up, staffed and able to be used for a patient within the reporting period. This includes all overflow, observation, and active surge/expansion beds used for inpatients, as well as ICU beds. Because this metric is reported as a percent of staffed beds (including overflow), the denominator may vary over time based on staffing and how many overflow beds are set up. Inclusion of all surge/hallway/overflow beds that are open for use for a patient in the staffed inpatient beds in use by COVID-19 patients may result in an overestimate of remaining capacity.

Geographic unit of analysis for COVID-19 Community Level indicators

Analysis of these data at the local level is complicated by unequal distribution of hospitals within regions, as they are often clustered in large population centers and have service areas that overlap and extend across multiple communities. The unequal distribution of hospitals leads to a mismatch between places where people live and places where they receive care. This issue is particularly relevant in rural communities or those with relatively small populations, many of which have no

hospitals or have hospitals with few inpatient beds. More complex hospital care (including critical care) may only be available at the very largest hospitals, often located in metropolitan areas with a very large catchment. Spatial aggregation of small geographic units (e.g., counties) to match the catchment area of local hospitals involving HSAs reflect hospital utilization patterns. HSAs reflect service areas of hospitals and helps reallocate patients to surrounding areas and align with county boundaries.[17-19]

An HSA is defined by CDC's National Center for Health Statistics as a geographic area containing at least one county which is self-contained with respect to the population's provision of routine hospital care. Every county in the United States is assigned to an HSA, and each HSA must contain at least one hospital. While "county" has previously been used as a geographic area to display these metrics since it is typically the smallest geographic unit for which national data are available, not all counties in the United States have hospitals. As a result, county-level analyses of hospital data can result in inaccurate local population estimates. (/nchs/data/series/sr_02/sr02_112.pdf). Use of HSAs in the calculation of COVID-19 Community Level indicators allows for more accurate characterization of the relationship between health care utilization and health status at the local level.

Data sources for case incidence rates

Total cases are based on aggregate counts of COVID-19 cases reported by state and territorial jurisdictions to the Centers for Disease Control and Prevention (CDC). In accordance with the CSTE definition of COVID-19 cases and deaths, counts for many jurisdictions include both confirmed and probable COVID-19 cases. For aggregate state-level data, CDC calculates the number of new cases each day either by using the information provided by states and territorial jurisdictions or by calculating the difference in cumulative counts reported by the state from the day before.

Establishing thresholds for COVID-19 Community Level indicators

To establish thresholds for COVID-19 Community Level indicators, an iterative process was used that involved testing different thresholds and combinations of thresholds. Historical data and thresholds used in the COVID-19 Community Profile Report and the State Profile Report were reviewed. These two reports provide daily metrics based on established thresholds reflecting trend data at the state and county level. Finally, a review of historical trends in increases and declines in cases, hospital metrics, and other data was conducted. Correlation analyses indicated that 100 new cases per 100,000 population per week corresponds to approximately 3–4% inpatient beds occupied by COVID-19 patients, and 6 –10 new hospital admissions for COVID-19 per 100,000 population. The thresholds from the Community Profile Report were also used as an initial starting point and adjusted in subsequent testing. Evaluation of thresholds used an iterative process that assessed: 1) how the thresholds resulted in different levels at key time points over the course of surges, peaks, declines, and low points between waves in case rates; and 2) how well different combinations of thresholds performed in predicting outcomes 2–6 weeks later. In addition, the proportion of counties at each level at key timepoints were assessed to determine the proportion of counties during peaks and low points.

COVID-19 Community Level Indicator Performance

Analyses assessed COVID-19 Community Levels and indicators as predictors of outcomes and compared performance against community transmission levels. Outcomes selected included measures of severe disease from COVID-19, healthcare strain, and deaths: *new COVID-19 hospital admissions*, *percent of staffed inpatient beds occupied with COVID-19 patients*, *percent of staffed Intensive Care Unit (ICU) beds occupied with COVID-19 patients*, and *COVID-19 deaths per population.* New correlation analyses assessed the optimal lag between indicators and outcomes. Results indicated that a 3-week lag (compared to 1, 2, 4, 5, and 6 weeks) yields the highest correlations for all outcomes for both community transmission levels and COVID-19 Community Levels. Therefore, a 3-week interval was used in subsequent analyses.

Performance of community transmission levels and COVID-19 Community Levels at predicting outcomes 3 weeks later were assessed using Area Under Receiver Operating Characteristic (AUROC) analyses. AUROC analyses 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 or higher COVID-19 Community Level. A score of 0.50 would correspond to random chance and a score of 1 would indicate that worse outcomes always correspond to a higher transmission or higher COVID-19 Community Level. AUROC values reflect the likelihood that for two counties with different levels, the county with the higher severity has the most severe outcome 3 weeks later. Analyses involved multiple phases. First, analyses compared

performance of community transmission levels to COVID-19 Community Levels (using 4 levels of each). Based on results, the COVID-19 Community Levels were adjusted to include 3 levels (low, medium, high). Then, analyses compared different combinations of threshold levels for COVID-19 community levels.

Comparison of performance of COVID-19 Community Level indicators against community transmission indicators

Iterative testing of COVID-19 Community Levels assessed performance against community transmission indicators in predicting outcomes 3 weeks later. The first phase used 4 COVID-19 Community Levels, similar to the 4-level approach used in community transmission. Analyses included 4 outcomes: *percent of staffed ICU beds occupied by COVID-19 patients*, *deaths from COVID-19*, *new admissions of COVID-19 per 100,000 population in the past 7 days*, and *percent of staffed inpatient beds occupied by COVID-19 patients*. AUROC analyses compared the performance of COVID-19 Community Levels against community transmission and compared performance of COVID-19 Community Levels using different combinations of thresholds (higher/lower *new COVID-19 admissions*; higher/lower *percent inpatient beds occupied by COVID-19 patients*; various thresholds for *new COVID-19 cases* or not including cases) using data from 3/1/2021-1/24/2022.

Key findings were as follows:

- All combinations of thresholds for COVID-19 Community Levels had higher AUROC values than community transmission levels. For the *staffed ICU beds occupied by COVID-19 patients*, *new COVID-19 hospital admissions*, and *percent inpatient beds occupied by COVID-19 patients* outcomes, average AUROC values for community transmission levels ranged from .65-.69, whereas average AUROC values for COVID-19 Community Levels ranged from .71-.80. For *deaths from COVID-19*, average AUROC values were .60-.61 for community transmission and .63-.65 for COVID-19 Community Level.
- Analyses that included *new COVID-19 cases* as a COVID-19 Community Level indicator also resulted in better performance over COVID-19 Community Level defined only by *new COVID-19 hospital admissions* and *percent inpatient beds occupied*. Using 200 new cases per 100,000 as a threshold provided better prediction compared to using 500 new cases per 100,000 or 1,000 new cases per 100,000 in predicting all outcomes 3 weeks later.
- Across all analyses, the COVID-19 Community Levels provide an improvement over the community transmission levels in identifying regions that will experience severe outcomes 3 weeks later. This can be attributed primarily to the following factors: 1) three indicators are used instead of two making the result less sensitive to outliers or missing data; and 2) the new indicators selected have a higher correlation with future outcomes than test positivity.

Based on the AUROC analysis results, threshold combinations for *new COVID-19 hospital admissions*, *percent inpatient beds occupied by COVID-19 patients*, and *new COVID-19 cases* indicators were selected that *optimized* performance of COVID-19 Community Levels in predicting outcomes.

The indicators and thresholds were then qualitatively validated through individual discussions with jurisdictional stakeholders and experts from hospital and clinical care settings, based on their experiences at various points during case surges and declines. Qualitative validation discussions included public health (representing state and local jurisdictions), infectious diseases, and hospital administration experts to obtain input on the usefulness and relevance of the framework and how well the thresholds reflected hospital and public health experience. The experts provided general feedback that validated the thresholds, and strongly recommended simplifying the framework by using only 3 levels, rather than 4, to define COVID-19 Community Levels. Therefore, AUROC analyses were repeated to assess thresholds using only 3 levels.

Comparison of performance of combinations of threshold levels

Analyses compared performance using the combinations of threshold levels below and reflected in rows in Table 2:

- **Low admissions, low inpatient beds**: low thresholds for *new COVID-19 hospital admissions* (<10.0; 10.0-19.9; ≥0) and *percent inpatient beds occupied by COVID-19 patients* (<5.0%; 5.0-9.9%; ≥10.0%); combined with three threshold levels for *new COVID-19 cases* (≥200, ≥500, and ≥1,000 new cases per 100,000 population) and not including cases as an indicator.
- **Low admissions, high inpatient beds**: low thresholds for *new COVID-19 hospital admissions* (<10.0; 10.0-19.9; ≥20.0) and high thresholds for *percent inpatient beds occupied by COVID-19 patients* (<10.0%; 10.0-14.9%; ≥15.0%) and using ≥200 *new COVID-19 cases per 100,000 population*.

- **High admissions, high inpatient beds**: high thresholds for *new COVID-19 hospital admissions* (<20.0; 20.0-29.9; ≥30.0) and *percent inpatient beds occupied by COVID-19 patients* (<10.0%; 10.0-14.9%; ≥15.0%); combined with three threshold levels for *new COVID-19 cases* (≥200, ≥500, and ≥1,000 new cases per 100,000 population) and not including cases as an indicator.

The three COVID-19 community levels in Table 2 are labeled Low, Medium, and High.

All combinations of thresholds provided strong performance predicting all outcomes, with minimal differences between threshold combinations (Table 2). Overall, the combination of lower thresholds for *new COVID-19 hospital admissions* and *percent inpatient beds occupied by COVID-19 patients*, and ≥200 *new COVID-19 cases per 100,000 population*, provided strong overall performance at discriminating between High and Medium/Low levels, with AUROC values ranging from .70 (for *deaths*) to .86 (for *inpatient beds*), and the overall highest average AUROC value (.81). These thresholds were selected as they provide the best distinction between High and Medium/Low levels, resulting in more interpretable information in identifying counties that have high potential for experiencing healthcare strain.

TABLE 2. County-level Area Under Receiver Operating Characteristic (AUROC) analyses for predictors in columns and outcomes in rows 3 weeks later

	High versus Medium/Low				
COVID-19 Community Level Threshold	New COVID-19 Hospital Admissions per 100,000 Population 3 Weeks Later	Percent of Inpatient Beds Occupied with COVID-19 Patients 3 Weeks Later	Percent of ICU Beds Occupied with COVID-19 Patients 3 Weeks Later	COVID-19 Deaths per 100,000 Population 3 Weeks Later	Average AUROC value
Low admissions, low inpatient beds, cases 200/100K	0.84	**0.86**	**0.82**	0.71	**0.81**
Low admissions, low inpatient beds, cases 500/100K	0.83	0.85	0.81	0.70	0.80
Low admissions, high inpatient beds, cases 200/100K	0.8	**0.86**	0.81	0.71	**0.81**
High admissions, high inpatient beds, cases 200/100K	0.83	**0.86**	0.81	**0.72**	**0.81**
High admissions, high inpatient beds, cases 500/100K	0.83	0.84	0.80	0.71	0.80
High admissions, high inpatient beds, no cases	0.82	0.84	0.80	0.71	0.79

Analysis includes data from 3/1/2021-1/24/2022. Value reflects the likelihood that for two counties with different levels, the county with the higher severity has the most severe outcome 3 weeks later. The highest value in each column is shown in bold.

The COVID-19 Community Level indicators in Table 1reflect the best performing cut points. The COVID-19 Community Level Overview and Scientific Rationale includes maps comparing COVID-19 community levels and community transmission levels at key points from 2021-2022.

Public health recommendations

Public health and individual recommendations for prevention measures informed by COVID-19 Community Levels are intended to minimize severe disease and prevent strain on the healthcare system, especially for disproportionately affected populations. Recommendations reflect a priority on implementing prevention measures when individuals are at particularly high risk and communities have the potential for healthcare system strain. Specific individual- and household-level prevention behaviors are recommended for each level of COVID-19 Community Level (Table 5), to provide individuals information based on their level of risk for severe disease. Community-level prevention measures are also recommended for each COVID-19 Community Level.

- At the **Low level,** individual and community-level recommendations focus on best practices in infection prevention and control in community settings, in addition to promoting up-to-date vaccinations as the front-line strategy to protect from severe disease. These include improving ventilation, testing to identify infection early, and following recommendations for isolation and after an exposure.
- The **Medium level** strengthens emphasis on protecting people who are immunocompromised or at increased risk for severe disease, and enhanced prevention measures for high-risk settings.
- At the **High level**, additional recommendations for individuals and communities focus on wearing masks indoors in public and providing added protection to populations at high risk.

Recommendations are intended to be additive, in that recommendations for the low community level apply to the medium and high levels, and the additional recommendations for medium level apply to the high level. Recommendations are provided for individuals and for community settings such as schools, and for some high-risk congregate settings. COVID-19 community levels may not apply to healthcare settings such as hospitals or long-term care facilities, which can continue to follow infection control guidance for healthcare settings.

The COVID-19 Community Level indicators and recommendations are intended to provide a broad framework for jurisdictions to use and adapt as needed based on local needs (Figure 1). Public health officials and jurisdictions can use local information (like wastewater surveillance) and metrics (like syndromic surveillance data) to interpret the information provided by the COVID-19 Community Levels and provide context to assess the need for public health intervention. In certain circumstances, public health officials may decide to take urgent public health actions regardless of the information provided by the COVID-19 Community Levels. For example, in the context of the emergence of a novel variant of concern, public health officials may decide to recommend additional precautions to ensure public health and safety until more information becomes available to guide public health recommendations. Jurisdictions should monitor COVID-19 Community Levels weekly to determine community public health recommendations. To ensure stability in data and implementation of public health interventions, prevention strategies should be increased or relaxed based on weekly changes in COVID-19 Community Levels. Importantly, public health efforts for community-level strategies should ensure equitable access to support services (like testing) and vaccination, as well as pre-exposure, post-exposure, and early treatment for those who are eligible.

Vaccination

The preponderance of available evidence shows that people who have completed the primary COVID-19 vaccination series, and a booster when eligible, are at substantially reduced risk of severe illness and death from COVID-19.[1] The cumulative rate of COVID-19-associated hospitalizations is substantially higher in unvaccinated adults than in those who are up to date on vaccines. This pattern applies to all age groups, but is most pronounced among adults aged 65 years and older, who are at increased risk for hospitalization and death.[3] Therefore, vaccines, including booster doses when appropriate, provide a substantial measure of protection against COVID-19-associated hospitalization and severe disease.[1-3,12,15] Vaccines may also provide protection from post-COVID conditions.[20] CDC recommends that all people get vaccinated as soon as they are eligible, and stay up to date on vaccinations to protect themselves and their family members (including children under age 5 who are not yet eligible for vaccination). As with vaccines for other diseases, people who are up to date are optimally protected. Additional doses of vaccines are recommended for people with immunocompromising conditions to provide optimal protection from COVID-19 hospitalization.[21] People with moderate to severe immunocompromising conditions should also discuss options for use of Pre-Exposure Prophylaxis with their healthcare providers.[22] Evidence indicates that vaccination after recovery from COVID-19 infection provides added immune protection.[6]

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Masks

SARS-CoV-2 infection is transmitted predominantly by inhalation of respiratory droplets generated when people cough, sneeze, sing, talk, or breathe. Well-fitting masks are primarily intended to reduce the emission of virus-laden droplets by the wearer ("source control"), which is especially relevant for asymptomatic or pre-symptomatic infected wearers who feel well and may be unaware of their infectiousness to others.[23-24] Studies demonstrate that wearing well-fitting masks also provides protection to the wearer by reducing wearers' exposure to infectious droplets through filtration, including filtration of fine droplets and particles less than 10 microns.[25] Improving fit and filtration – for example, through strategies such as using mask fitters or layering a cloth mask over a medical procedure mask – can improve wearer protection.[25] The community benefit of wearing well-fitting masks for SARS-CoV-2 control is due to the combination of source control and filtration protection for the wearer; the individual prevention benefit of wearing masks increases with increasing numbers of people using masks consistently and correctly in a given setting.[25-26]

CDC recommends that people consistently and correctly wear a well-fitting mask indoors in public when communities are at a high level. People who are immunocompromised or at increased risk for severe disease should wear a mask or respirator that provides greater protection to the wearer at medium and high levels. At medium and high levels, people who have social contact with someone immunocompromised or at high risk for severe disease may consider wearing a mask when indoors with them. At low COVID-19 Community Levels, individual decisions to wear a mask should be informed by individual risk. At all levels, individuals should wear a well-fitting mask if they have symptoms of COVID-19, if they had a positive SARS-CoV-2 test in the past 10 days, or if they had recent exposure to someone with SARS-CoV-2 infection.

Viral testing

Testing for SARS-CoV-2 infection is part of the essential package of public health tools to respond to COVID-19.

Diagnostic testing to identify infection should be performed at all COVID-19 Community Levels for anyone with symptoms consistent with COVID-19 and individuals with recent known or suspected exposure to SARS-CoV-2. Rapid access to testing is essential to identify infections early and reach individuals who may need care. Public health officials should continue to expand broad access to testing – including laboratory testing as well as point-of-care and at-home tests – and ensure health equity and reach for populations at high risk for severe disease.

Ventilation

The principal mode by which people are infected with SARS-CoV-2 is through exposure to respiratory fluids carrying infectious virus.[31] SARS-CoV-2 viral particles spread between people more readily indoors than outdoors. Indoors, the concentration of viral particles is often higher than outdoors, where even a light wind can rapidly reduce concentrations. When indoors, improving ventilation can reduce viral particle concentration. The lower the concentration, the less likely viral particles can be inhaled into the lungs (potentially lowering the inhaled dose). Interventions and practices that improve ventilation can reduce the airborne concentrations of viral particles and reduce the overall viral dose to occupants.[32]

Improving ventilation is an important COVID-19 prevention strategy to reduce the number of virus particles in the air. Bringing fresh outdoor air into a building helps keep virus particles from concentrating inside. This can be done by opening multiple doors and windows, using fans to increase the effectiveness of open windows, and making changes to HVAC or air filtration systems.[32-34] At the high COVID-19 Community Level, additional options to improve ventilation include planning activities outdoors and keeping windows and doors open, when feasible.

TABLE 3. Individual prevention behaviors and community-level public health prevention strategies based on COVID-19 community level

COVID-19 Community Level	Individual- and household-level prevention behaviors	Community-level prevention strategies (as recommended by state or local authorities)

COVID-19 Community Level	Individual- and household-level prevention behaviors	Community-level prevention strategies (as recommended by state or local authorities)

Low	• Stay up to date with COVID-19 vaccines and boosters
	• Maintain improved ventilation throughout indoor spaces when possible
	• Follow CDC recommendations for isolation and after exposures, including getting tested if you are exposed to COVID-19 or have symptoms of COVID-19
	• If you are immunocompromised or high risk for severe disease
	  – Have a plan for rapid testing if needed (e.g., having home tests or access to testing)
	  – Talk to your healthcare provider about whether you are a candidate for treatments like oral antivirals, PrEP, and monoclonal antibodies
		• Distribute and administer vaccines to achieve high community vaccination coverage and ensure health equity
		• Maintain improved ventilation in public indoor spaces
		• Ensure access to testing, including through point-of-care and at-home tests for all people
		  – Communicate with organizations and places that serve people who are immunocompromised or at high risk for severe disease to ensure they know how to get rapid testing
		• Ensure access and equity in vaccination, testing, treatment, community outreach, support services for disproportionately affected populations

Medium	• If you are immunocompromised or high risk for severe disease
	  – Wear a mask or respirator indoors in public
	  – Have a plan for rapid testing if needed (e.g., having home tests or access to testing)
	  – Talk to your healthcare provider about whether you are a candidate for treatments like oral antivirals, PrEP, and monoclonal antibodies
	• If you have household or social contact with someone at high risk for severe disease consider wearing a mask when indoors with them
	• Stay up to date with COVID-19 vaccines and boosters
	• Maintain improved ventilation throughout indoor spaces when possible
	• Follow CDC recommendations for isolation and after exposures, including getting tested if you are exposed to COVID-19 or have symptoms of COVID-19
		• Protect people at high risk for severe illness or death by ensuring equitable access to vaccination, testing, treatment, support services, and information
		• Implement enhanced prevention measures in high-risk congregate settings (see guidance for correctional facilities and homeless shelters
		• Distribute and administer vaccines to achieve high community vaccination coverage and ensure health equity
		• Maintain improved ventilation in public indoor spaces
		• Ensure access to testing, including through point-of-care and at-home tests for all people
		  – Communicate with organizations and places that serve people who are immunocompromised or at high risk for severe disease to ensure they know how to get rapid testing
		• Ensure access and equity in vaccination, testing, treatment, community outreach, support services for disproportionately affected populations

COVID-19 Community Level	Individual- and household-level prevention behaviors	Community-level prevention strategies (as recommended by state or local authorities)

High	• Wear a well-fitting mask[1] indoors in public, regardless of vaccination status (including in K-12 schools and other indoor community settings)
	• If you are immunocompromised or high risk for severe disease
	  – Wear a mask or respirator indoors in public
	  – Consider avoiding non-essential indoor activities in public where you could be exposed
	  – Have a plan for rapid testing if needed (e.g., having home tests or access to testing)
	  – Talk to your healthcare provider about whether you are a candidate for treatments like oral antivirals, PrEP, and monoclonal antibodies
	• If you have household or social contact with someone at high risk for severe disease consider wearing a mask when indoors with them
	• Stay up to date with COVID-19 vaccines and boosters
	• Maintain improved ventilation throughout indoor spaces when possible
	• Follow CDC recommendations for isolation and after exposures, including getting tested if you are exposed to COVID-19 or have symptoms of COVID-19
		• Consider setting-specific recommendations for prevention strategies based on local factors
		• Implement healthcare surge support as needed
		• Protect people at high risk for severe illness or death by ensuring equitable access to vaccination, testing, treatment, support services, and information
		• Implement enhanced prevention measures in high-risk congregate settings (see guidance for correctional facilities and homeless shelters)
		• Distribute and administer vaccines to achieve high community vaccination coverage and ensure health equity
		• Maintain improved ventilation in public indoor spaces
		• Ensure access to testing, including through point-of-care and at-home tests for all people
		  – Communicate with organizations and places that serve people who are immunocompromised or at high risk for severe disease to ensure they know how to get rapid testing
		• Ensure access and equity in vaccination, testing, treatment, community outreach, support services for disproportionately affected populations

[1] At all levels, people can wear a mask based on personal preference, informed by personal level of risk. People with symptoms, a positive test, or exposure to someone with COVID-19 should wear a mask.

Conclusion

High levels of immune protection provided by vaccination and prior infection have greatly reduced the risk of severe illness, hospitalization, and death from COVID-19 for most people. In addition to protecting those at highest risk of severe outcomes (particularly those with immunocompromising conditions), focusing on reducing medically significant illness and minimizing healthcare strain are primary goals given the public health tools available at this stage of the pandemic. COVID-19-related hospitalization is strongly associated with ICU care and deaths, as well as other outcomes including higher healthcare costs and societal impacts due to absenteeism from work.[28-29]

Vaccines are highly protective against severe disease[1-4,15] and continuing to expand vaccine coverage is essential to protecting individuals against COVID-19-associated hospitalizations and deaths.[3] Emerging evidence also suggests that vaccinated people who are subsequently infected with COVID-19 are less likely to report symptoms of post-COVID conditions.[20]

The COVID-19 Community Level can inform decisions about COVID-19 prevention strategies, including vaccinations, wearing masks, and avoiding crowded settings.[11] Enhancement of these prevention measures can be informed by COVID-19 Community Levels, to preserve healthcare capacity for adequate treatment of those with COVID-19 and other urgent health

Community Levels, to preserve healthcare capacity for adequate treatment of those with COVID-19 and other urgent health conditions, and to protect individuals from severe disease, especially those at increased risk.[13] Performance of COVID-19 Community Levels will be reassessed as the pandemic continues to evolve. The COVID-19 Community Level framework can adjust to accommodate changes in factors such as viral dynamics, emergence of novel variants of concern, or ecological changes that affect indicator data (such as shifts to greater use of self-testing or changes in reporting cadence).

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