

JURISDICTIONAL SCAN

(ARCHIVED) Jurisdictional Scan of Frameworks and Epidemiologic Indicators to Inform Public Health Measures during COVID-19

Published: November 2020

Archived: December 2023

ARCHIVED DOCUMENT

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Key points

- The indicators and thresholds to inform Coronavirus Disease 2019 (COVID-19) public health measures (PHMs) vary by framework. Most jurisdictions include measures of COVID-19 activity (case incidence per 100,000 population, percent of all tests that are positive) and health care system capacity (hospitalizations, intensive care unit [ICU] bed availability). Other indicators used include doubling time, hospital visits for COVID-19-like illness, deaths and effective reproduction number (R_e).
- In the 20 jurisdictions reviewed, nine did not provide specific thresholds that would be applied to the stated epidemiologic indicators to guide COVID-19 control strategies and measures.
- Of the frameworks identified, indicators and corresponding thresholds generally described triggers for action over four or five categories of risk.
- For jurisdictions that provided thresholds, the lowest incidence thresholds to trigger additional PHMs and/or action ranged from <1 to 9 daily average cases per 100,000, 0.2 to 24.9 per 100,000 cumulative over 7 days, and <10-30 per 100,000 cumulative over 14 days.
- Across frameworks reviewed, the highest thresholds to trigger the most stringent public health measures, including 'lockdown' thresholds, were the most challenging to identify. Based on this scan, the highest thresholds varied greatly by jurisdiction, likely reflecting the overall decision-making context and/or goals in those jurisdictions. For example, the incidence per 100,000 thresholds range from ≥ 4 to ≥ 25 daily average cases, > 0.4 to ≥ 300 cumulative over 7 days, and > 100 to ≥ 150 cumulative over 14 days.

- It is important to note that due to different testing capacity and COVID-19 epidemiology across frameworks identified, applicability to the Ontario context is unclear.

Background

The Public Health Agency of Canada (PHAC) has provided four guiding principles for lifting or implementing PHMs.¹ First, decisions should be based on current epidemiology and be science-based and guided by advice from public health officials. Second, jurisdictions should ensure collaboration and coordination in response activities. Third, jurisdictions should be transparent in decision-making and sharing data. Fourth, implementation or relaxation of PHMs should occur in a stepwise manner and be based on the current science.

Recently, Han et al. examined the lessons learned from the easing of restrictions in eastern Asia and Europe, highlighting four important lessons.² First, jurisdictions should be transparent in which epidemiological and other factors have been used to inform easing or implementation of PHMs, with explicit threshold and indicator details for when to transition between phases. Second, jurisdictions should have capacity to track the effective reproduction number (R_e), with appropriate interpretation at various geographical scales. Third, jurisdictions should, where possible, communicate, educate and engage with communities to establish an acceptable new normal life where recent public health measures may have a lasting presence (e.g., face mask wearing, and changes in social interactions). Fourth, jurisdictions should have an effective find, test, trace, isolate, and support system in place.

With the need for dynamic decision-making in response to changing community epidemiology of COVID-19, and in the absence of a vaccine or other pharmaceutical options, frameworks may be a useful tool to support transparency and communication with the public, upon whom public authorities rely to adopt and/or participate in PHMs.³ Framework-based approaches may serve to provide a clear description of the epidemiologic indicators and their respective thresholds for when and where to increase community-based PHMs, or when to ease PHMs. Depending on the context, frameworks may support a jurisdiction's values, priorities and response goals for prevention of morbidity and mortality and minimizing societal disruption.³

Purpose and Scope

In this jurisdictional scan, we aim to identify publicly available frameworks that guide public health measures in response to COVID-19, for select jurisdictions with relevance to the Province of Ontario, and aim to summarize the epidemiologic indicators and thresholds used within frameworks. This scan aims to be useful to decision-makers to inform understanding of epidemiologic indicators and corresponding thresholds and/or triggers for public health action implemented in other jurisdictions. Details on resurgence measures implemented in response to epidemiologic thresholds were out of scope for this scan but information can be found elsewhere.^{4,5} Indicators for public health system and health care system capacity are critical inputs for decision-making; however, they were not the focus of this scan. Where possible, we abstracted capacity indicators alongside epidemiologic indicators for reference.

Methods

For this jurisdictional scan, Public Health Ontario (PHO) Library Services developed several web search queries (first 50 results examined) to help identify frameworks and associated indicators and thresholds (Appendix A). Jurisdictional scans of select government and public health agency websites, along with

media reports, were conducted on November 13, 2020. The list of jurisdictions selected was not exhaustive but aimed to include examples from other Canadian provinces, the United States (US), the United Kingdom (UK), Europe and Australia. For the purposes of this document, indicators were converted to per 100,000 to make comparable. It is important to note that this scan does not examine the effectiveness of the frameworks or indicators in controlling community COVID-19 epidemiology.

Findings: Overview of Relevant Frameworks and Corresponding Epidemiological Indicators and Triggers

We examined frameworks and their associated indicators and thresholds for 20 jurisdictions. Additional details are summarized in Appendix B.

World Health Organization (WHO)

The WHO highlights essential aspects to take into account when developing response frameworks and epidemiological indicators and thresholds.⁶ Firstly, jurisdictions should understand the current level of transmission in the community. Secondly, jurisdictions need to assess health care system capacity (clinical care and public health measures) to respond. PHM implementation or discontinuation must take into account effectiveness and make sure they minimize unintended consequences. Moving from one level to another must occur quickly in a step-wise manner. Epidemiology and current science should inform PHMs at various geographical scales, rather than universally.

The WHO interim guidance on considerations for implementing and adjusting public health and social measures in the context of COVID-19 (updated November 4, 2020 from the original guidance dated April 16, 2020), provides a list of indicators for different tiers of community outbreak levels (i.e., from low to very high incidence). The primary epidemiological indicators related to hospitalization rate per 100,000, mortality per 100,000, case incidence per 100,000 and testing percent positivity all over a cumulative 14-day period. Additional categories of transmission classification have been provided with labels of no cases, imported/sporadic cases, and clusters of cases. Abstraction has focused on community transmission.

Community transmission level 1:

- Hospitalization rate: <5 per 100,000
- Mortality: <1 per 100,000
- Case incidence: <20 per 100,000
- Testing % positivity from sentinel sites: <2%

Community transmission level 2:

- Hospitalization rate: 5-<10 per 100,000
- Mortality: 1-<2 per 100,000
- Case incidence: 20-<50 per 100,000

- Testing % positivity from sentinel sites: 2-<5%

Community transmission level 3:

- Hospitalization rate: 10-<30 per 100,000
- Mortality: 2-<5 per 100,000
- Case incidence: 50-<150 per 100,000
- Testing % positivity from sentinel sites: 5-<20%

Community transmission level 4:

- Hospitalization rate: ≥ 30 per 100,000
- Mortality: ≥ 5 per 100,000
- Case incidence: ≥ 150 per 100,000
- Testing % positivity from sentinel sites: $\geq 20\%$

Numerous other epidemiological indicators are described including their limitations: ICU proportional occupancy, R_e , doubling time, proportion of unlinked cases amongst new cases, overall (non-sentinel) test positivity, influenza-like illness or severe acute respiratory infection trends, all-cause hospitalization rate trends, and all-cause (excess) mortality trends. Health system and public health system capacity indicators are also listed, but are out of scope for this review.

North America

CANADA

On May 30, 2020, the Federal/Provincial/Territorial Special Advisory Committee of PHAC published seven criteria with fourteen indicators to be recommended to assess the need for easing or re-implementing measures.¹ PHAC acknowledges that the application of these criteria in each province or territory's own phased transition plans is under their control. As such, there are no quantitative thresholds provided.

Five steps for transitioning from full lockdown measures were provided with setting-specific suggestions for PHM modifications. The suggestions appear to be unidirectional (i.e., for easing PHMs), but could be adapted to re-implementation of PHMs. The final step may only be reached once a vaccine or treatment are available.

No specific guidance on period to measure incidence is provided.

ONTARIO

The government of Ontario announced a new framework for implementation of public health measures on November 3, 2020, with a revision to thresholds published on November 13, 2020.^{7,8} This framework is a colour-coded framework (green, yellow, orange, red, grey).

The thresholds relate to epidemiology, health system capacity, and public health system capacity; detailed public health measures are available in the publication, COVID-19 Response Framework: Keeping Ontario Safe and Open.⁸ The epidemiological thresholds are summarized below. Incidence is measured as cumulative 7-day incidence per 100,000.

Prevent (standard measures) – green

- Weekly incidence rate <10/100,000
- <0.5% test positivity
- $R_e < 1$
- Outbreak trends/observations
- Level of community transmission/non-epidemiologically linked cases stable

Protect (strengthened measures) – yellow

- Weekly incidence rate 10.0–24.9/100,000
- 0.5–1.2% test positivity
- R_e is approximately 1
- Repeated outbreaks in multiple sectors/settings OR increasing/number of large outbreaks
- Level of community transmission/non-epidemiologically linked cases stable or increasing

Restrict (intermediate measures) – orange

- Weekly incidence rate 25–39.9/100,000
- 1.3–2.4% test positivity
- R_e is approximately 1.0–1.1
- Repeated outbreaks in multiple sectors/settings, increasing/number of large outbreaks
- Level of community transmission/non-epidemiologically linked cases stable or increasing

Control (stringent measures) – red

- Weekly incidence rate $\geq 40/100,000$
- $\geq 2.5\%$ test positivity
- $R_e \geq 1.2$
- Repeated outbreaks in multiple sectors/settings, increasing/number of large outbreaks
- Level of community transmission/non-epidemiologically linked cases increasing

Lockdown (maximum measures) – grey

- Trends continue to worsen after measures from Control level are implemented

ALBERTA

Alberta's Relaunch Strategy was announced on April 30, 2020. Their adaptive regional classification system uses three colour-based levels and a publicly available map of regional classification became available at the beginning of June, 2020.^{9,10} Only the top level (enhanced – purple zones) contains its own set of targeted public health measures.¹¹

It is not specified whether incidence values are totals for a given time period or daily rates or averages. Active is defined on the assumption that a case is recovered 14 days after a particular date. For confirmed cases, specimen collected date is used, and for probable cases, the date reported to Alberta Health is used. If a case is hospitalized, the recovered date is when their symptoms have resolved based on case follow-up, or 10 days after being discharged.¹²

Open

- Fewer than 50 active cases per 100,000

Watch – (blue zones)

- At least 10 active cases and greater than 50 active cases per 100,000

Enhanced – (purple zones)

- Informed by local context

The Alberta Relaunch Strategy is operating in tandem with the colour-based regional classification system and uses additional indicators for determining transition within a three-stage system.¹⁰ However, it is not clear how these two systems affect one another. Additional health indicators, beyond those used for transition within the colour-based levels, are mentioned as important to the transition between stages of the Alberta Relaunch Strategy.

BRITISH COLUMBIA

The British Columbia (BC) Restart Plan, a living document originally released on May 6, 2020, consists of four phases.¹³ It is not clear whether the phases are bidirectional (i.e., whether an area can revert back a stage based on COVID-19 epidemiology, or if the stages are only for the purpose of easing PHMs). Currently BC is in Phase 3b. BC states that movement between phases is based on effectiveness of measures in BC and reported elsewhere, as well as based on new scientific knowledge about COVID-19. BC models local and global case rates and assesses effectiveness of PHMs locally.¹⁴

To date, during each of the phases, various provincial health officer orders and guidance have been enacted and appealed.^{15,16} PHMs are stated to be eased based on consideration of the following: 14-day incubation period in relation to policy changes (e.g., opening businesses); the number of confirmed and recovered COVID-19 cases (e.g., cases per 100,000, percent positivity, weekly hospitalization); monitoring whether outbreaks are connected and their location, size and severity; and how other jurisdictions are responding to the pandemic.¹³

Based on routine epidemiological reporting, incidence per 100,000 is cumulative weekly incidence per 100,000; hospitalizations, deaths, and new outbreaks are cumulative weekly totals; percent positivity is a weekly average.

MANITOBA

Manitoba's #RestartMB Pandemic Response System from August 19, 2020, provides four colour-based risk levels (limited risk level – green; caution level – yellow; restricted level – orange; critical level – red). There are details of possible PHMs that could be applied in each level.^{17,18} Their pandemic response system document also provides scenarios for setting-specific responses that may occur based on different degrees of outbreaks.

Thresholds are not explicitly quantitatively defined for moving between levels, but Manitoba health authority takes into account a combination of multiple indicators from epidemiology, health and public system capacity, and risk of outbreaks in vulnerable settings to determine setting regional risk levels. COVID-19 transmission measures are either an average across 5 days or the 7 day cumulative (total) number.

QUEBEC

Under the Progressive Regional Alert and Intervention System (COVID-19) released on September 18, 2020, the government of Québec uses a four-level, colour-coded classification (vigilance – green, level 1; early warning – yellow, level 2; alert – orange, level 3; maximum alert – red, level 4).¹⁹ Each alert level has a respective information page for the setting-specific measures applied.²⁰⁻²⁴

Indicators are stated to be based on the epidemiological situation, transmission control, and healthcare system capacity. At this time, no quantitative thresholds have been released for use in conjunction with the progressive regional alert and intervention system. No specific guidance on period to measure incidence was reported.

NEW BRUNSWICK

From New Brunswick's COVID-19 Fall Pandemic Response and Preparedness Plan 2020 (August 17, 2020) and recovery plan, both use a four-level colour-coded alert system (green, yellow, orange and red).^{25,26} Each alert level is associated with general and setting-specific PHMs.

Thresholds for increasing alert levels to stricter control measures are related to epidemiology, public health capacity and health care capacity. Triggers for re-assessment of the assigned alert level are provided, however, are specific to increasing alert levels and do not detail how alert levels are reduced.^{26,27}

The epidemiologic indicators are:

- Doubling time of cases in less than six days (not applicable if number of cases is low).
- More than three unlinked chains of community transmission in less than a six-day period.
- Outbreaks in high vulnerability settings where there is risk of transmission to the community.

UNITED STATES

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

The CDC has listed some examples of indicators that may be useful for communities to use to determine readiness to implement, remove or reinforce PHMs.²⁸ These include COVID-19 epidemiology (e.g., total and incident COVID-19 cases, percent positivity of SARS-CoV-2 testing, number and type of outbreaks, rates in vulnerable populations) as well as healthcare capacity, and public health capacity indicators. Four levels of community transmission associated with a qualitative level of mitigation were released on May 27, 2020.²⁹

- Substantial, uncontrolled transmission; shelter in place.
- Substantial, controlled transmission; significant mitigation.
- Minimal to moderate community transmission; moderate mitigation.
- No to minimal community transmission; low mitigation.

However, no quantified thresholds are provided to determine movement amongst those levels. Based on epidemiology reports the incidence rates are cumulative weekly rates per 100,000. However, for school setting indicators 14 day cumulative rates per 100,000 are used and other variations. So, it is not clear which measure would be used for broader (non-school-specific) thresholds.³⁰

PREVENT EPIDEMICS

Prevent Epidemics is a non-profit organization that advises governments on epidemic preparedness. In response to the COVID-19 pandemic in the US, Prevent Epidemics developed the guidance *COVID-19 Alert-Level System Indicators, Triggers and Thresholds*.³¹ Their framework is based on seven indicators organized into three categories: 1) disease situation, 2) health care system, and 3) disease control. Incidence is a daily average across 7 days; percent positivity is a daily average across 7 days (ideally data informing percent positivity are from unique individuals).³²

- Level 1 (new normal): incidence <1.0/100,000 [incidence originally measured as 10/1,000,000, changed to 1/100,000 for ease of comparison] per day; percent positivity <5% per day
- Level 2 (low alert): incidence 1.0–1.9/100,000 per day; 5–9% percent positivity
- Level 3 (moderate alert): 2.0–3.9/100,000 per day; 10–14% percent positivity
- Level 4 (high alert): ≥4.0/100,000 per day; ≥15% percent positivity

Movement up to a higher level occurs when increasing to meet new threshold over a 7-day period. Movement to a lower level occurs when decreasing to meet a new threshold over a 14-day period (or 7-day period for percent positivity).

HARVARD GLOBAL HEALTH INSTITUTE

The Harvard Global Health Initiative developed *Key Metrics for COVID Suppression*, a framework that focuses on case incidence as sole indicator.³³ The framework also has an interactive map that can be used to explore risk levels by congressional district. This framework focuses on average daily new case incidence per 100,000, based on a seven day rolling average as an indicator.

Green

- Daily new incidence <1/100,000 seven day rolling average

Yellow

- Daily new incidence 1–9/100,000 seven day rolling average

Orange

- Daily new incidence 10–24/100,000 seven day rolling average

Red

- Daily new incidence ≥25/100,000 seven day rolling average

Two other metrics are also suggested:

Metric 2: Case trend as an estimate from new deaths trend: New daily deaths per 100,000 population * 100 (assuming 1% infection fatality rate) (seven day rolling average)

Metric 3: New daily hospitalizations per 100k pop (seven day rolling average)

OHIO

Ohio uses a *Public Health Advisory System* as part of its framework to manage COVID-19.³⁴ The advisory system is colour-coded, with the intent to support statewide orders “through a data-driven framework to assess the degree of the virus’ spread and to engage and empower individuals, businesses, communities, local governments, and others in their response and actions.” Ohio uses seven indicators (as of July 29, 2020), arranged in three broad areas: 1) case data, 2) symptom data, and 3) hospitalization data. In this scan we focus on case incidence and percent positivity (measures for percent positivity are currently under developed and therefore have not yet been reported).³⁵ Incidence refers to cumulative total of incidence per 100,000 over two weeks.

- Level 1 (yellow): 0–1 indicators met or incidence <10/100,000 over two weeks
- Level 2 (orange): 2–3 indicators met
- Level 3 (red): 4–5 indicators met or so long as incidence remains >100/100,000 over two weeks
- Level 4 (purple): 6–7 indicators met for two consecutive weeks

When new incidence has remained >50/100,000 over two weeks, then this indicator is considered met.

ILLINOIS

In the guidance *Actions to Combat a Resurgence of COVID-19* released May 5, 2020,³⁶ Illinois focuses on three indicators (percent positivity, hospital admissions, and ICU bed capacity), none of which are incidence indicators, for when to implement restrictive measures. Percent positivity is a daily average across 7 days. These indicators and additional indicators related to public health system capacity are used to move into phases with less strict public health measures.³⁷⁻⁴¹

The indicators used to increase restrictions by moving to a stricter phase are:

- Sustained increase in 7-day rolling average in percent positivity rate

AND ONE OF THE FOLLOWING:

- Sustained 7-day increase in hospital admissions for COVID-19-like illness
- ICU capacity or medical/surgical beds <20%

OR

- 3 consecutive days averaging $\geq 8\%$ positivity (7-day average)

Moving out of phase 1:

- Slowing of new case growth
- Availability of surge capacity in adult medical and surgical beds, ICU beds, and ventilators
- Ability to perform 10,000 tests per day statewide
- Testing available in region for any symptomatic health care workers and first responders

Moving from phase 2 to phase 3:

- At or under a 20 percent positivity rate and increasing no more than 10 percentage points over a 14-day period, AND
- No overall increase (i.e. stability or decrease) in hospital admissions for COVID-19-like illness for 28 days, AND
- Available surge capacity of at least 14 percent of ICU beds, medical and surgical beds, and ventilators.
- Testing available for all patients, health care workers, first responders, people with underlying conditions, and residents and staff in congregate living facilities
- Begin contact tracing and monitoring within 24 hours of diagnosis

Moving from phase 3 to phase 4:

- Same as phase 2 to phase 3.

Moving from phase 4 to phase 5:

- Vaccine, effective and widely available treatment, or the elimination of new cases over a sustained period of time through immunity or other factors.

In addition to the indicators listed above, a regression to a previous phase could also be influenced by a significant outbreak in the region that threatens the health of the region

CALIFORNIA

The California state released a Tier Framework on August 28, 2020 with their *Blueprint for a Safer Economy* that uses two indicators (average daily new cases per 100,000 over 7-days with 7-day lag; testing percent positivity 7-day average with 7-day lag) and a set of health equity measures to dictate movement between four tiers of community disease transmission risk.⁴²⁻⁴⁴ The health equity measures listed were data collection, testing access, contact tracing, supportive isolation, and outreach that demonstrate a county's ability to address the most impacted communities within a county. Further, health outcomes such as case rates, hospitalizations and deaths, will also be developed and tracked for improvement. The equity metrics requirements are applied only to counties with populations greater than 106,000.

Tier 1 (widespread) – purple

- 7-day average with 7-day lag new cases $>7 / 100,000$
- 7-day average with 7-day lag testing percent positive $>8\%$

Tier 2 (substantial) – red

- 7-day average with 7-day lag new cases $4-7 / 100,000$
- 7-day average with 7-day lag testing percent positive $5-8\%$

Tier 3 (moderate) – orange

- 7-day average with 7-day lag new cases $1.0-3.9 / 100,000$
- 7-day average with 7-day lag testing percent positive $2-4.9\%$

Tier 4 (minimal) – yellow

- 7-day average with 7-day lag new cases $<1 / 100,000$
- 7-day average with 7-day lag testing percent positive $<2\%$

Some additional conditions apply for moving between tiers. A county must remain in a tier for at least three weeks to be moved to a later tier. A later tier is assumed in this review to mean a less restrictive tier. A county may advance to an earlier tier (i.e., stricter set of restrictions) within two weeks. Movement may only be one tier at a time; however, an 'emergency brake' is an option available to counties to enact on an immediate basis based on factors such as hospitalizations. The most restrictive tier will be applied based on the indicators reported.

Alternate case assessment measures are applied to counties with less than 106,000 for yellow, orange and red tiers. Therefore, if case positivity indicates a lower tier, but case rates indicate a higher tier based on the regular Tier Framework, then the following thresholds are applied.

Population $\leq 35,000$:

- Yellow: 7-day average with 7-day lag new cases $7 / 100,000$
- Orange: 7-day average with 7-day lag new cases $14 / 100,000$

- Red: 7-day average with 7-day lag new cases 35 / 100,000

Population 35,000-70,000:

- Yellow: 7-day average with 7-day lag new cases 14 / 100,000
- Orange: 7-day average with 7-day lag new cases 21 / 100,000
- Red: 7-day average with 7-day lag new cases 42 / 100,000

Population 70,000-106,000:

- Yellow: 7-day average with 7-day lag new cases 21 / 100,000
- Orange: 7-day average with 7-day lag new cases 28 / 100,000
- Red: 7-day average with 7-day lag new cases 49 / 100,000

Europe

UNITED KINGDOM

In the UK framework (May 11, 2020 with updates on July 17, 2020), *Our plan to rebuild: The UK Government's COVID-19 recovery strategy*, the intent is to identify how intense social distancing measures should be.⁴⁵ Specific indicators and thresholds are not reported, however a news article states that levels are determined based on R_e and the number of SARS-CoV-2 cases at any one time. These levels are used by UK governments to make decisions about their own national or local responses.

- Level 1 (green): COVID-19 is not present in the UK
- Level 2: number of cases and transmission are low
- Level 3: epidemic is in general circulation
- Level 4: transmission is high or rising exponentially
- Level 5 (red): same as level 4, but risk of healthcare services being overwhelmed

SCOTLAND

Scotland has its own framework entitled the *Strategic Framework* (October 23, 2020) and uses five indicators, including incidence per 100,000 (over 7 days), percent positivity (over 7 days) and three health care system capacity predictive modelling metrics (forecasts of the number of cases per 100,000 consisting of the weekly number of cases in two weeks' time; current and projected future use of local hospital beds, compared with capacity; and, current and projected future use of intensive care beds, compared with capacity).^{46,47} Incidence is a cumulative 7 day incidence; percent positivity is a daily average calculated from a 7-day period.

- Level 0: incidence <20/100,000 and <1.5% positivity
- Level 1: incidence 20–74/100,000 and 1.5–2.9% positivity

- Level 2: incidence 75–149/100,000 and 3.0–4.9% positivity
- Level 3: incidence 150–299/100,000 and 5.0–9.9% positivity
- Level 4: incidence $\geq 300/100,000$ and $\geq 10.0\%$ positivity

IRELAND

Ireland's framework *Resilience and Recovery 2020-2021: Plan for Living with COVID-19* (Sept 15, 2020) has five alert levels, however, triggers and thresholds for indicators are not provided.⁴⁸ Incidence is calculated on 14-day and 7-day cumulative incidence as well as 5-day rolling averages (probably per 100,000 though not clearly stated). Increasingly restrictive public health measures are imposed when moving from one level to the next higher level.

BELGIUM

The Belgium framework *COVID-19 Control Tower* focuses on 14-day incidence per 100,000.⁴⁹ An exact date that the control tower model was released is not clear, but may be around mid-October or earlier. Incidence is assessed at national and provincial level over 14 days (cumulative).

- No alarm: no or only a few sporadic infections
- Pre-alarm phase: 1-14/100,000
- Alarm level 1: 15-30/100,000
- Alarm level 2: 31-50/100,000
- Alarm level 3: 51-100/100,000
- Alarm level 4: $>100/100,000$

The overview adds that trends of figures, percentage of positive tests and an open 'additional information' relating to the nature of local outbreaks are all taken into account. Measures are intended to be applied as locally as possible though federal measures may apply at alarm level 3 and 4.

CZECH REPUBLIC

The Ministry of Health in the Czech Republic has developed a framework focusing on measures of community transmission.⁵⁰ This framework was announced July 1, 2020. Incidence is cumulative over 7 days per 100,000.

- Level 0 (white): cumulative number of newly diagnosed patients with COVID-19 in the given area in the past 7 days $>25/100,000$
- Level 1 (green): average daily increase in the number of positive cases in the past 7 days is 50% higher compared to the average of the previous 7 days
- Level 2 (yellow): 7 day increase in proportion of cases over the age of 65 exceeding 50%
- Level 3 (red): proportion of hospitalized COVID-19 cases exceeding 2% of active cases

Australia

Australia's *Framework for National Reopening* employs a traffic light system for managing COVID-19 mitigation measures, introduced in October, 2020, where indicators focus on the state-level epidemiological situation, percent positivity and health care system capacity.⁵¹ Incidence is cumulative of 7 days per 100,000; percent positivity is the average daily percent positivity of testing in the past 7 days.

- Green (maintain, monitor and report): 7-day average <50 cases reported nationally, incidence <0.2/100,000, <0.25% positivity and 20% probability that $R_e > 1$
- Yellow (targeted adjustments needed): 7-day average 50–100 cases reported nationally, incidence 0.2–0.4/100,000, 0.25–0.50% positivity and 20–49% probability that $R_e > 1$
- Red (harder, wider, different response): 7-day average >100 cases reported nationally, incidence >0.4/100,000, >0.50% positivity and >50% probability that $R_e > 1$

Additional metrics are measured with thresholds from interstate travel incidence (same as within state transmission), and overseas acquisition and considerations for regional and remote cases.

Summary

For this jurisdictional scan, we reviewed 20 frameworks and associated indicators and thresholds, including 13 from North America (seven from Canada; six from the US), five in Europe (including UK), one from Australia, and one international health organization. This scan did not attempt to be exhaustive but provides examples from other jurisdictions with health systems and context potentially relevant to Ontario.

The specific indicators and thresholds vary by framework, although most jurisdictions included measures of COVID-19 activity (i.e., case incidence per 100,000 population, percent of all tests that were positive) and health care system capacity (hospital ward and ICU bed availability). Other less commonly used indicators included epidemic doubling time, hospital visits for COVID-19-like illness, deaths and effective reproduction number (R_e). This is broadly consistent with the recommendations by PHAC and WHO that core indicators should include measure of current disease activity (incidence, percent positivity, R_e), with an assessment of current health care system (hospital usage) and public health (testing, contact tracing, isolation) capacity.^{1,6}

In terms of the spectrum represented across the frameworks, for jurisdictions that provided thresholds, the lowest incidence thresholds to trigger additional PHMs and/or action ranged from <1 to 9 daily average cases, 0.2 to 24.9 cumulative over 7 days, and <10–30 cumulative over 14 days. Across frameworks reviewed, the highest thresholds to trigger the most stringent public health measures, including 'lockdown' thresholds, were the most challenging to identify. Based on this scan, the highest thresholds varied greatly by jurisdiction, likely reflecting the overall decision-making context and/or goals in those jurisdictions. For example, the incidence per 100,000 thresholds range from ≥ 4 to ≥ 25 daily average cases, >0.4 to ≥ 300 cumulative over 7 days, and >100 to ≥ 150 cumulative over 14 days. The application of lockdown PHMs is the subject of a forthcoming scan by PHO.

Of the frameworks identified, only the US State of California was identified as including indicators pertaining to equity as part of their framework. California has implemented The California Health Equity Metric which requires that counties meet an equity metric or demonstrate targeted investments to

eliminate disparities in COVID-19 transmission.⁴³ The equity metric aims to ensure that percent positivity rates in most disadvantaged neighbourhoods do not significantly lag behind the overall county rate. A health equity approach to COVID-19 in Canada is important to address the disproportionate impacts of the COVID-19 pandemic on some populations and geographies, as noted by Canada's Chief Public Health Officer in An Equity Approach to COVID-19.⁵² Further work is needed to consider how equity metrics may contribute to informing epidemiological thresholds and public health action during the pandemic. A forthcoming PHO scan will examine health equity actions in public health COVID-19 response.

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Appendix A. Jurisdictional Scan Web Search

Web search queries:

- **coronavirus OR covid OR sars** threshold OR trigger OR indicator lockdown OR restrictions OR "stay at home" OR measures OR quarantine OR "public health interventions" OR isolation OR distancing OR bubble
- **coronavirus OR covid OR sars** threshold OR trigger OR indicator closed or closure OR cancel or shutdown OR ban school OR daycare OR childcare OR gym OR fitness OR restaurant OR bar OR gathering
- **coronavirus OR covid OR sars** threshold OR trigger OR indicator framework OR "plan" OR stage OR phase OR level OR "COVID-19 response" OR "coronavirus response" OR "response to COVID-19" OR "response to coronavirus"
- **coronavirus OR covid OR sars** epidemiology OR incidence OR prevalence OR "case rate" OR outbreak OR cluster OR "community transmission" OR positivity OR "Rt" OR "reproduction number" OR hospitalization OR death OR mortality lockdown OR restrictions OR "stay at home" OR measures OR quarantine OR "public health interventions" OR isolation OR distancing OR bubble
- **coronavirus OR covid OR sars** epidemiology OR incidence OR prevalence OR "case rate" OR outbreak OR cluster OR "community transmission" OR positivity OR "Rt" OR "reproduction number" OR hospitalization OR death OR mortality closed or closure OR cancel or shutdown OR ban school OR daycare OR childcare OR gym OR fitness OR restaurant OR bar OR gathering
- **coronavirus OR covid OR sars** epidemiology OR incidence OR prevalence OR "case rate" OR outbreak OR cluster OR "community transmission" OR positivity OR "Rt" OR "reproduction number" OR hospitalization OR death OR mortality framework OR "plan" OR stage OR phase OR level OR "COVID-19 response" OR "coronavirus response" OR "response to COVID-19" OR "response to coronavirus"

Search concepts legend:

- coronavirus
- thresholds
- indicators
- lockdown
- closures
- response plans/phases

Appendix B. Jurisdictional scan of frameworks for epidemiologic indicators and thresholds

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<p>Thresholds for indicators to dictate transition between steps was explicitly stated to be set by each jurisdiction.</p> <p>Note: no specific guidance on period to measure incidence.</p>
Canada – National (PHAC) ¹	<p>Step 1: Near-term</p> <p>Step 2: Short-term</p> <p>Step 3: Medium-term</p> <p>Step 4: Longer-term</p> <p>Step 5: Lifting all restrictions</p> <p>Step 5 only comes into effect once significant population immunity has been achieved.</p>	<p>1. COVID-19 transmission is controlled</p> <ul style="list-style-type: none"> Indicator 1.1: Number of cases (linked and non-linked), hospitalizations, intensive care unit (ICU) admissions and deaths per day Indicator 1.2: Reproduction number, absolute and relative changes in cases, hospitalizations and deaths <p>2. Sufficient public health capacity is in place to test, trace and isolate all cases</p> <ul style="list-style-type: none"> Indicator 2.1: Testing capacity Indicator 2.2: Resources to trace contacts Indicator 2.3: Ability to isolate all cases Indicator 2.4: Ability to quarantine all contacts <p>3. Expanded health care capacity exists: the incidence of new cases should be maintained at a level that the health system can manage including substantial clinical care capacity to respond to surges</p> <ul style="list-style-type: none"> Indicator 3.1: Critical care capacity Indicator 3.2: Availability of personal protective equipment (PPE)

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<p>4. Supports are in place for vulnerable groups/communities and key populations to minimize outbreak risks</p> <ul style="list-style-type: none"> Indicator 4.1: Availability of guidance for staff and residents to prevent transmission among vulnerable groups/settings Indicator 4.2: Number, size, and status of outbreaks in high vulnerability settings <p>5. Workplace preventive measures are established to reduce risk</p> <ul style="list-style-type: none"> Indicator 5.1: Availability of guidance for workers and employers to prevent transmission of COVID-19 in the workplace Indicator 5.2: Number of workplace outbreaks <p>6. Avoiding risk of importation of cases</p> <ul style="list-style-type: none"> Indicator 6.1: Number of international travel-related cases <p>7. Engage and support communities to adjust to the new normal</p> <ul style="list-style-type: none"> Indicator 7.1: Communications strategies in place <p>Note: Incidence is cumulative 7-day incidence per 100,000.</p>
Canada – Provincial (Ontario) ^{7,8}	<p><i>COVID-19 Response Framework: Keeping Ontario Safe and Open</i></p> <p>November 13, 2020 version.</p> <p>Prevent (standard measures) – green</p> <ul style="list-style-type: none"> Education and awareness of public health and workplace safety measures in place. Short of full re-opening in lieu of a widely available vaccine or treatment, this is the least restrictive set of measures. 	<p><u>Prevent (standard measures) – Green</u></p> <p>Epidemiology</p> <ul style="list-style-type: none"> Weekly incidence rate <10/100,000 <0.5% positivity $R_e < 1$ Outbreak trends/observations Level of community transmission/non-epi linked cases stable <p>Health System Capacity</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<ul style="list-style-type: none"> Highest risk settings remain closed. <p>Protect (strengthened measures) – yellow</p> <ul style="list-style-type: none"> Measures are enforced more actively with fines and education improved to limit transmission. Public health measures are applied in high risk settings. <p>Restrict (intermediate measures) – orange</p> <ul style="list-style-type: none"> Enhanced measures, added restrictions, further enforcement, but avoid closures. <p>Control (stringent measures) – red</p> <ul style="list-style-type: none"> Broad-scale measures and restrictions across multiple sectors are applied to control transmission. Restrictions fall short of widescale business or organizational closure. <p>Lockdown (maximum measures) – grey</p> <ul style="list-style-type: none"> Widescale closures and lockdown measures. Consideration is made for declaration of state of emergency. <p>Indicators will generally be assessed based on previous two weeks of information; though measures may be applied sooner if there are rapidly worsening trends.</p>	<ul style="list-style-type: none"> Hospital and ICU capacity adequate <p>PH System Capacity</p> <ul style="list-style-type: none"> Case and contact follow up within 24 h adequate <p><u>Protect (strengthened measures) – Yellow</u></p> <p>Epidemiology</p> <ul style="list-style-type: none"> Weekly incidence rate 10.0–24.9/100,000 0.5–1.2% positivity R_e is approximately 1 Repeated outbreaks in multiple sectors/settings OR increasing/# of large outbreaks Level of community transmission/non-epi linked cases stable or increasing <p>Health System Capacity</p> <ul style="list-style-type: none"> Hospital and ICU capacity adequate <p>PH System Capacity</p> <ul style="list-style-type: none"> Case and contact follow up within 24 h adequate <p><u>Restrict (intermediate measures) – Orange</u></p> <p>Epidemiology</p> <ul style="list-style-type: none"> Weekly incidence rate 25–39.9/100,000 1.3–2.4% positivity R_e is approximately 1.0–1.1 Repeated outbreaks in multiple sectors/settings, increasing/# of large outbreaks Level of community transmission/non-epi linked cases stable or increasing <p>Health System Capacity</p> <ul style="list-style-type: none"> Hospital and ICU capacity adequate or occupancy increasing <p>PH System Capacity</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Regional implementation by PHU boundaries</p> <p>Qualitative risk assessment will be performed by Ontario Government to determine movement between measures wherein thresholds may not be all met, but a decision to move to new measures is advised.</p>	<ul style="list-style-type: none"> Case and contact follow up within 24 hours adequate or at risk of becoming overwhelmed <p><u>Control (stringent measures) – Red</u></p> <p>Epidemiology</p> <ul style="list-style-type: none"> Weekly incidence rate $\geq 40/100,000$ $\geq 2.5\%$ positivity $R_e \geq 1.2$ Repeated outbreaks in multiple sectors/settings, increasing/# of large outbreaks Level of community transmission/non-epi linked cases increasing <p>Health System Capacity</p> <ul style="list-style-type: none"> Hospital and ICU capacity at risk of being overwhelmed <p>PH System Capacity</p> <ul style="list-style-type: none"> Public health unit capacity for case and contact management at risk or overwhelmed <p><u>Lockdown (maximum measures) – Grey</u></p> <ul style="list-style-type: none"> Trends continue to worsen after measures from Control level are implemented
	<p><i>Progressive Regional Alert and Intervention System (COVID-19)</i></p>	<p>No quantitative thresholds for movement between alert levels were reported</p>
Canada – Provincial (Québec) ^{19,24}	<p>Vigilance – green (Level 1): community spread is weak</p> <ul style="list-style-type: none"> Basic measures (physical distancing, respiratory etiquette, hand washing, etc) are in place with specific measures added to settings, if necessary. 	<p>Note: no specific guidance on period to measure incidence.</p> <p>Three factors were identified as indicators for setting alert levels:</p> <ol style="list-style-type: none"> Epidemiological situation Transmission control Healthcare system capacity

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Early warning – yellow (Level 2): transmission begins to increase and basic measures are inadequate to contain spread</p> <ul style="list-style-type: none"> Strengthened basic measures wherein additional efforts are made to promote and encourage compliance (e.g., inspections, crowd control in busy settings). <p>Alert – orange (Level 3): spread continues and high-risk areas must be targeted to reduce transmission</p> <ul style="list-style-type: none"> Intermediate measures wherein higher-risk activities are restricted or prohibited. <p>Maximum alert – red (Level 4): containment measures are not effective from alert level, thus requiring strict restrictions or prohibitions</p> <ul style="list-style-type: none"> Maximum measures that require widespread restrictions and possible prohibition of non-essential activities. This level seeks to balance restrictions with reduced feeling of confinement. <p>Each of Québec’s socio-health regions sets alert classification</p>	
Canada – Provincial (Manitoba) ^{17,18}	<p><i>#RestartMB Pandemic Response System</i></p> <p>Limited risk level – green: spread is extremely limited in part due to either the availability of a vaccine or effective treatment</p>	<p>No quantitative thresholds for movement between alert levels were reported.</p> <p>Alert levels and setting-specific responses are modified based on a combination of multiple indicators.</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<ul style="list-style-type: none"> Basic enhanced hygiene measures are recommended. <p>Caution level – yellow: community transmission is at low levels</p> <ul style="list-style-type: none"> Few limitations on movement and indoor gatherings, and few restrictions on activity, business and public services. <p>Restricted level – orange: community transmission is at moderate levels</p> <ul style="list-style-type: none"> More limitations on movement and indoor gatherings, and moderate restrictions on activity, business and public services offerings; few closures. <p>Critical level – red: community transmission is at critical levels, containment is not working and/or the health care system cannot keep up with demand</p> <ul style="list-style-type: none"> Significant limitations on movement and indoor gatherings, and strict restrictions on activity, business and public service offerings including possible widespread closures; limiting activity and businesses to essential services. <p>The provincial health agency leads response and alert level designation.</p>	<p>Note: As indicated COVID-19 transmission measures are either an average across 5 days or the 7 day cumulative (total) number.</p> <p>COVID-19 Transmission</p> <ul style="list-style-type: none"> 5 d average of emergency department and urgent care patients presenting with influenza-like illness 5 d average percent positivity 7 d average of number of lab tests completed 7 d total number of unknown acquisition cases in the community <p>Health System Capacity</p> <ul style="list-style-type: none"> Overall intensive care unit capacity usage as measured by the total number of vacant ICU beds, the number of new ICU patients in the last seven days, and the number of current COVID-19 ICU patients Overall non-ICU hospital capacity as measured by the total number of vacant medicine beds, the number of new COVID-19 medicine patients in the last seven days, and the number of current COVID-19 medicine patients Remaining supply (in days) of personal protective equipment <p>Public Health Capacity</p> <ul style="list-style-type: none"> % of contacts traced within 24 h Total lab-testing capacity % of the population living within 150 km of alternative isolation facilities and the occupancy rate at alternative isolation facilities <p>Risk of Outbreaks in Vulnerable Settings</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	Setting-specific modifications may occur within a given level rather than broadly shifting alert levels.	<ul style="list-style-type: none"> 7 d total of COVID-19 cases among staff and residents in vulnerable settings (personal care homes, homeless shelters) Total number of active respiratory illness outbreaks in health care settings (not limited to COVID-19) Risk of Importation of Cases <ul style="list-style-type: none"> 7 d total number of COVID-19 cases associated with travel (international or domestic)
	<i>Alberta Relaunch Strategy</i>	
	April 30, 2020.	Targeted public health measures indicators (specific)
	Regional classification by municipal boundaries	
	Open – beige: low level of risk <ul style="list-style-type: none"> No additional restrictions in place beyond basic measures. 	Note: It is not specified whether incidence values are totals for a given time period or daily rates or averages. Active is defined on the assumption that a case is recovered 14 days after a particular date. For confirmed cases, specimen collected date is used and for probable cases date reported to Alberta Health is used. If a case is hospitalized, the recovered date is when their symptoms have resolved based on case follow-up, or 10 days after being discharged.
Canada – Provincial (Alberta) ⁹⁻¹²	Watch – blue: risk is monitored and local government(s) and community leaders as cases have risen above a threshold <ul style="list-style-type: none"> A possible need for additional measures beyond basic measures is under consideration, but not yet applied. 	Open: Fewer than 50 active cases per 100,000 Watch: At least 10 active cases and greater than 50 active cases per 100,000 Enhanced: Informed by local context
	Enhanced – purple: risk levels require enhanced public health measures to control the spread <ul style="list-style-type: none"> Enhanced public health measures are applied to control the spread, tailored to the specific region. 	Alberta Relaunch Strategy indicators (broad) <ul style="list-style-type: none"> Health-care system capacity Hospitalization and ICU cases Infection rates

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>A three-stage system, the <i>Alberta Relaunch Strategy</i>, is currently in the second stage. It is not clear how this three-stage system and the regional classification are complementary.</p> <p><i>BC's Restart Plan</i></p> <p>Phase 1: Ended May 18, 2020: SARS-CoV-2 transmission dynamics were being rapidly uncovered and understanding was developing as a public health emergency and provincial state of emergency had been declared.</p> <ul style="list-style-type: none"> Essential travel only, physical distancing and business closures to help stop the spread of COVID-19. <p>Phase 2 (ended June 23, 2020): businesses were cautiously re-opened with strict guidelines to maintain low rates of transmission.</p> <ul style="list-style-type: none"> Essential travel only, physical distancing, restart of many businesses including those that were ordered closed. Regional modifications to public health measures are ordered and repealed by the Provincial health Officer. <p>Phase 3: current phase: Continuation of risk levels and transmission seen in Phase 2, with a Phase 3b based on the start of the 2020–2021 school year.</p>	<p>Thresholds have not been reported.</p> <p>Changes between phases are based on effectiveness of intervention measures in British Columbia and elsewhere, and new scientific knowledge about COVID-19.</p> <p>Note: based on routine epidemiological reporting, incidence per 100,000 is cumulative weekly incidence per 100,000; hospitalizations, deaths, and new outbreaks are cumulative weekly totals; percent positivity is weekly average.</p> <p>Specific indicators have not been reported, instead general indicators are listed:</p> <ul style="list-style-type: none"> 14-d incubation period COVID-19 cases (cases per 100,000; % positivity; weekly hospitalization; deaths) New outbreaks What's happening elsewhere
Canada – Provincial (British Columbia) ¹³⁻¹⁶		

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<ul style="list-style-type: none"> Smart and safe travel within the province, restart of in-person K-12 and post-secondary classes. This phase has been divided into Phase 3a and Phase 3b based on the start of the 2020-2021 school year. <p>Phase 4: conditional on global availability of vaccine or treatment.</p> <ul style="list-style-type: none"> International tourism, restart of large gatherings including concerts and conferences. <p>A regional-level approach is taken for enhancement and relaxation of measures.</p>	
	<p><i>COVID-19 Fall Pandemic Response and Preparedness Plan 2020 / NB's Recovery Plan</i></p> <p>Green level: population prepared for future communicable disease outbreaks; vaccine or effective treatment available.</p>	<p>Assessing the need to revert to higher risk levels occurs under two circumstances:</p> <ul style="list-style-type: none"> If one threshold in each of two of the three categories of indicators is met, then reverting to one higher alert level is considered. If one or more threshold in each of three categories, or more than one threshold in a single category plus one threshold in any of the other two categories would result in transition to red alert level.
Canada – Provincial (New Brunswick) ²⁵⁻²⁷	<ul style="list-style-type: none"> Basic hygiene measures. <p>Yellow level: COVID-19 is controlled, still a risk of isolated community outbreaks, and sporadic travel-related cases.</p> <ul style="list-style-type: none"> Physical distancing and standard public health measures to mitigate risk associated with sporadic cases or clusters. 	<p>Epidemiology</p> <ul style="list-style-type: none"> Doubling time of cases in less than six days (not applicable if number of cases is low). More than three unlinked chains of community transmission in less than a six-day period. Outbreaks in high vulnerability settings where there is risk of transmission to the community.

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Orange level: significant risk that COVID-19 is no longer controlled as a result of travel-related cases, and new chains of community transmission that are increasing.</p> <ul style="list-style-type: none"> Restrictions on non-essential close contact activities, both socially and in some workplaces, to address a high risk of community transmission. <p>Red Level: COVID-19 is no longer controlled. Chains of transmission are unlinked. Public health measures are not sufficiently effective, and public health and health care capacity is overwhelmed.</p> <ul style="list-style-type: none"> Strong restrictions to limit unnecessary movement of people and contacts to contain community transmission and outbreaks. <p>Alert levels are assigned by health zones.</p>	<p>Public Health Capacity</p> <ul style="list-style-type: none"> 10% or more of all contacts cannot be reached by Public Health within 24 h Public Health is not able to reach or actively monitor all identified close contacts within 48 h Insufficient facilities for non-hospitalized COVID-19 infected people who cannot be safely cared for at home (i.e. vulnerable populations, group settings which do not allow for self-isolation) Compliance with public health directives and recommendations are no longer being followed by the public (i.e. physical distancing, masking). <p>Health Care Capacity</p> <ul style="list-style-type: none"> Inability to scale up to two times the number of intensive care unit patients from current census (including staffing) Health system can no longer screen and test the required number of symptomatic patients in a timely manner Less than a four week supply of personal protective equipment for double the current case load Insufficient face masks to provide to all patients seeking care even if cases double More admissions than discharges for COVID-19 over three consecutive days Do not have baseline capacity in general health services, including through expansion of telemedicine for COVID-19 and usual care

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<ul style="list-style-type: none"> Health-care facilities can no longer be structured to reduce possibility of exposure at triage and all other locations Increasing number of new health-care worker infections for six consecutive days (affect workforce, and indicates poor infection prevention and control practices)
		Thresholds for de-escalation were not stated
United States – National (CDC) 28,29	<p>The CDC has listed some examples of indicators intended for use in community settings to determine readiness to implement, remove or reinforce public health measures.</p> <p>Four levels of community transmission associated with a qualitative level of mitigation were released on May 27, 2020.</p> <ul style="list-style-type: none"> Substantial, uncontrolled transmission; shelter in place. Substantial, controlled transmission; significant mitigation. Minimal to moderate community transmission; moderate mitigation. No to minimal community transmission; low mitigation. 	<p>No quantified thresholds to determine movement amongst levels of mitigation are provided for the indicators listed.</p> <p>Note: Based on epidemiology reports the incidence rates are cumulative weekly rates per 100,000. However, in school indicators 14 day cumulative rates per 100,000 are used and other variations. So, it is not clear which measure would be used for broader (non-school-specific) thresholds.</p> <p>Epidemiology (e.g., total and incident COVID-19 cases, percent positivity of SARS-CoV-2 testing, number and type of outbreaks, rates in vulnerable populations).</p> <p>Health care capacity</p> <p>Public health capacity</p>
United States – National (Prevent Epidemics) ^{31,32}	<p><i>COVID-19 Alert-Level System Indicators, Triggers and Thresholds</i> (June 1, 2020)</p> <p>Level 1 (new normal)</p>	Indicators are classified in three broad categories:

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<ul style="list-style-type: none"> Few public health measures other than basic measures. <p>Level 2 (low alert)</p> <ul style="list-style-type: none"> Public health measures aimed to protect vulnerable populations, limitations on gatherings, and additional measures for various activities. <p>Level 3 (moderate alert)</p> <ul style="list-style-type: none"> Movement is restricted, schools are closed, very limited mass gatherings for specific reasons, modified retail/restaurants to pickup/delivery, and limited recreation. <p>Level 4 (high alert)</p> <ul style="list-style-type: none"> Stay at home measures enacted, no gatherings, mass closures and essential services only. 	<p>53. Disease situation (daily case incidence per 1,000,000; increase in people displaying symptoms of COVID-19 in last 5 days)</p> <p>54. Health care system (% ICU beds available over last 3 days; total healthcare worker infections over last 7 days)</p> <p>55. Disease control (% positivity over last 7 days, tests performed per 1,000/day over last 7 days; % of cases from quarantined contacts in last 3 days)</p> <p>Note: incidence is a daily average across 7 days; test positivity is a daily average across 7 days (ideally data informing test positivity is unique individuals).</p> <p>Thresholds for epidemiological indicators at each level were:</p> <p>Level 1 (new normal)</p> <ul style="list-style-type: none"> incidence <10/1,000,000 <5% positivity <p>Level 2 (low alert)</p> <ul style="list-style-type: none"> incidence 10–19/1,000,000 5–9% positivity <p>Level 3 (moderate alert)</p> <ul style="list-style-type: none"> incidence 20–39/1,000,000 10–14% positivity <p>Level 4 (high alert)</p> <ul style="list-style-type: none"> incidence ≥40/1,000,000 ≥15% positivity

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<p>Movement up to a higher level occurs when increasing to meet new threshold over a 7-day period. Movement to a lower level occurs when decreasing to meet a new threshold over a 14-day period (or 7-day period for positivity).</p> <p>Note: This framework focuses solely on average daily new case incidence per 100,000 based on a seven day rolling average as an indicator.</p>
United States – National (Harvard Global Health Initiative) ³³	<p><i>Key Metrics for COVID Suppression (July 1, 2020)</i></p> <p>Green</p> <ul style="list-style-type: none"> On track for containment; monitor with viral testing and contact tracing program <p>Yellow</p> <ul style="list-style-type: none"> Community spread; rigorous testing and contact tracing advised; careful selection of public health measures <p>Orange</p> <ul style="list-style-type: none"> Accelerated spread; stay-at-home orders advised in lieu of rigorous testing and contact tracing being able to meet surge levels <p>Red</p> <ul style="list-style-type: none"> Tipping point; stay-at-home orders required 	<p>Green</p> <ul style="list-style-type: none"> daily new incidence <1/100,000 seven day rolling average <p>Yellow</p> <ul style="list-style-type: none"> daily new incidence 1–9/100,000 seven day rolling average <p>Orange</p> <ul style="list-style-type: none"> daily new incidence 10–24/100,000 seven day rolling average <p>Red</p> <ul style="list-style-type: none"> daily new incidence ≥25/100,000 seven day rolling average <p>Two other metrics are also suggested:</p> <p>Metric 2: Case trend as an estimate from new deaths trend: New daily deaths per 100k pop * 100 (assuming 1% infection fatality rate) (seven day rolling average)</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
United States – State-level (Illinois) ³⁶⁻⁴¹	<i>Actions to Combat a Resurgence of COVID-19</i>	Metric 3: New daily hospitalizations per 100k pop (seven day rolling average) Note: Percent positivity is a daily average across 7 days.
	Documentation released May 5, 2020.	
	Assessment at regional level, indicators for when to implement restrictive measures	The indicators used to increase restrictions by moving to a more strict phase are:
	Phase 1 (rapid spread) <ul style="list-style-type: none"> The most restrictive set of public health measures are in place (e.g., stay at home is required and only essential businesses are open). 	<ul style="list-style-type: none"> Sustained increase in 7-day rolling average in % positivity rate AND ONE OF THE FOLLOWING: <ul style="list-style-type: none"> Sustained 7-day increase in hospital admissions for COVID-19-like illness ICU capacity or medical/surgical beds <20% OR <ul style="list-style-type: none"> 3 consecutive days averaging ≥8% positivity (7-day average)
	Phase 2 (flattening) <ul style="list-style-type: none"> Similarly restrictive to phase 1 with allowance for some non-urgent procedures and some outdoor activities allowed. 	Moving out of phase 1: <ul style="list-style-type: none"> Slowing of new case growth Availability of surge capacity in adult medical and surgical beds, ICU beds, and ventilators Ability to perform 10,000 tests per day statewide Testing available in region for any symptomatic health care workers and first responders
	Phase 3 (recovery) <ul style="list-style-type: none"> Small gatherings, minimal travel, and health care procedures of any kind allowed. Some non-essential businesses open, though food services are still takeout and pickup only. 	Moving from phase 2 to phase 3: <ul style="list-style-type: none"> At or under a 20 percent positivity rate and increasing no more than 10 percentage points over a 14-day period, AND No overall increase (i.e. stability or decrease) in hospital admissions for COVID-19-like illness for 28 days, AND
	Phase 4 (revitalization) <ul style="list-style-type: none"> Larger gatherings, school returns to in person, non-essential businesses open with restrictions. 	

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Phase 5 (Illinois restored)</p> <ul style="list-style-type: none"> Contingent on a vaccine or effective treatment. Re-opening of all sectors with basic hygiene measures permanently in place. 	<ul style="list-style-type: none"> Available surge capacity of at least 14 percent of ICU beds, medical and surgical beds, and ventilators. Testing available for all patients, health care workers, first responders, people with underlying conditions, and residents and staff in congregate living facilities Begin contact tracing and monitoring within 24 hours of diagnosis <p>Moving from phase 3 to phase 4:</p> <ul style="list-style-type: none"> Same as phase 2 to phase 3. <p>Moving from phase 4 to phase 5:</p> <ul style="list-style-type: none"> Vaccine, effective and widely available treatment, or the elimination of new cases over a sustained period of time through herd immunity or other factors. <p>In addition to the indicators listed above, a regression to a previous phase could also be influenced by a significant outbreak in the region that threatens the health of the region</p>
United States – State-level (Ohio) ^{34,35}	<p><i>Ohio Public Health Advisory System</i></p> <p>Seven indicators assessed at the county level in three main categories</p> <p>1. Case data (>50 cases/100,000 over 14 d, day over day increase in cases in 5 consecutive days over last 3 week;</p>	<p>When indicators are met at a given level, the county moves to that alert level.</p> <p>Note: Incidence refers to cumulative total of incidence per 100,000 over two weeks.</p> <ul style="list-style-type: none"> Level 1 (Yellow): 0–1 indicators met or <10 cases/100,000 over two weeks

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>cases not in congregate setting over 50% in one of last 3 week)</p> <p>2. Symptom data (increase in ED visits over 5 consecutive days with COVID-19-like symptoms or increase in COVID-19 diagnosis in last 3 week; same as ED, but in outpatient settings)</p> <p>3. Hospitalization data (consecutive 5 d increase in hospital admissions with COVID-19 in last 3 wk; ICU capacity exceeds 80% for 3 d in the last week and greater than 20% of ICU beds are being used for COVID-19 patients for 3 d in last week)</p> <p>Level 1 (Yellow)</p> <ul style="list-style-type: none"> Active exposure and spread; health orders in place. <p>Level 2 (Orange)</p> <ul style="list-style-type: none"> Increased exposure and spread; exercise high degree of caution and follow health orders in place (e.g., protection of high risk individuals). <p>Level 3 (Red)</p> <ul style="list-style-type: none"> Very high exposure and spread; limit activities as much as possible and follow all current health orders (e.g., limitations on gatherings and travel). <p>Level 4 (Purple)</p> <ul style="list-style-type: none"> Severe exposure and spread; only leave home for supplies and services and follow all current health orders (stay at home orders). 	<ul style="list-style-type: none"> Level 2 (Orange): 2–3 indicators met Level 3 (Red): 4–5 indicators met or >100 cases/100,000 in last 2 weeks Level 4 (Purple): 6–7 indicators met for two consecutive weeks <p>When new incidence has remained >50/100,000 over two weeks, then this indicator is considered met.</p>
United States – State-level (California) ⁴²⁻⁴⁴	<i>Blueprint for a Safer Economy: Tier Framework</i> (August 28, 2020)	Two indicators and a set of health equity measures dictate movement between four tiers of community disease transmission risk.

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Tier 1 (widespread) – purple</p> <ul style="list-style-type: none"> Outdoor gatherings of small size only, business are generally open if they are outdoors-based except retail and personal service settings that can operate indoors at significantly reduced capacity, and work from home is required. <p>Tier 2 (substantial) – red</p> <ul style="list-style-type: none"> Outdoor gatherings of small size with small indoor gatherings discouraged, business are generally open if they are outdoors-based except retail and personal service settings that can operate indoors at moderately reduced capacity (some additional significantly reduced capacity businesses are open), and work from home is required. <p>Tier 3 (moderate) – orange</p> <ul style="list-style-type: none"> Small indoor gatherings discouraged, business are generally open though some sectors operate at moderate to significantly reduced capacity, and work from home is recommended. <p>Tier 4 (minimal) – yellow</p> <ul style="list-style-type: none"> Small indoor gatherings discouraged, business are generally open though some sectors operate at moderately reduced capacity, and work from home is recommended. <p>Measures are applied at the county level.</p>	<p>Note: incidence is daily new cases per 100,000 (7-day average with 7-day lag); testing % positivity is 7-day average with 7-day lag.</p> <p>The health equity measures listed were data collection, testing access, contact tracing, supportive isolation, and outreach that demonstrate a county's ability to address the most impacted communities within a county. Further, health outcomes such as case rates, hospitalizations and deaths, will also be developed and tracked for improvement. The equity metrics requirements are applied only to counties with populations greater than 106,000.</p> <p>Tier 1 (widespread) – purple</p> <ul style="list-style-type: none"> 7-day average with 7-day lag new cases >7 / 100,000 7-day average with 7-day lag testing % positive >8% <p>Tier 2 (substantial) – red</p> <ul style="list-style-type: none"> 7-day average with 7-day lag new cases 4-7 / 100,000 7-day average with 7-day lag testing % positive 5-8% <p>Tier 3 (moderate) – orange</p> <ul style="list-style-type: none"> 7-day average with 7-day lag new cases 1.0-3.9 / 100,000 7-day average with 7-day lag testing % positive 2-4.9% <p>Tier 4 (minimal) – yellow</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<ul style="list-style-type: none"> 7-day average with 7-day lag new cases <1 / 100,000 7-day average with 7-day lag testing % positive <2% <p>Some additional conditions apply for moving between tiers. A county must remain in a tier for at least three weeks to be moved to a later tier. A later tier is assumed in this review to mean a less restrictive tier. A county may advance to an earlier tier (i.e., stricter set of restrictions) within two weeks. Movement may only be one tier at a time, however, an 'emergency brake' (also circuit breaker or fire break) is an option available to counties to enact on an immediate basis based on factors like hospitalizations. The most restrictive tier will be applied based on the indicators reported.</p> <p>Alternate case assessment measures are applied to counties with less than 106,000 for yellow, orange and red tiers. Therefore, if case positivity indicates a lower tier, but case rates indicate a higher tier based on the regular Tier Framework, then the following thresholds are applied.</p> <p>Population ≤35,000:</p> <ul style="list-style-type: none"> Yellow: 7-day average with 7-day lag new cases 7 / 100,000 Orange: 7-day average with 7-day lag new cases 14 / 100,000 Red: 7-day average with 7-day lag new cases 35 / 100,000 <p>Population 35,000-70,000:</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
		<ul style="list-style-type: none"> Yellow: 7-day average with 7-day lag new cases 14 / 100,000 Orange: 7-day average with 7-day lag new cases 21 / 100,000 Red: 7-day average with 7-day lag new cases 42 / 100,000 <p>Population 70,000-106,000:</p> <ul style="list-style-type: none"> Yellow: 7-day average with 7-day lag new cases 21 / 100,000 Orange: 7-day average with 7-day lag new cases 28 / 100,000 Red: 7-day average with 7-day lag new cases 49 / 100,000
United Kingdom – National ⁴⁵	<i>Our plan to rebuild: The UK Government's COVID-19 recovery strategy</i>	
	In the UK framework, increased social distancing occurs as level increases.	Specific thresholds not provided
	Level 1 (green): Country is open.	<ul style="list-style-type: none"> Level 1 (green): COVID-19 is not present in the UK
	Level 2 (blue): Minimal social distancing, enhanced tracing.	<ul style="list-style-type: none"> Level 2 (blue): number of cases and transmission are low
	Level 3 (yellow): Gradual restrictions relaxation.	<ul style="list-style-type: none"> Level 3 (yellow): epidemic is in general circulation
	Level 4 (orange): Social distancing continues.	<ul style="list-style-type: none"> Level 4 (orange): transmission is high or rising exponentially
	Level 5 (red): Lockdown begins.	<ul style="list-style-type: none"> Level 5 (red): same as level 4, but risk of healthcare services being overwhelmed
United Kingdom (Scotland) – National ^{46,47}	<i>COVID-19: Scotland's Strategic Framework</i> (October 23, 2020)	Scotland uses five indicators, including incidence per 100,000 (over 7 days), percent positivity (over 7 days) and three health care system capacity predictive modelling

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Level 0</p> <ul style="list-style-type: none"> Limited indoor gathering, otherwise generally everything is open (except nightclubs) with basic measures in place, work from home recommended as much as possible. 	<p>metrics (forecasts of the number of cases per 100,000 consisting of the weekly number of cases in two weeks' time; current and projected future use of local hospital beds, compared with capacity; and, current and projected future use of intensive care beds, compared with capacity).</p>
	<p>Level 1</p> <ul style="list-style-type: none"> Limited public indoor gathering, with no private gathering, only small indoor events, indoor contact sports restricted, partial closure of entertainment and leisure, limitations to business hours. 	<p>Note: incidence is a cumulative 7 day incidence; percent positivity is a daily average calculated from a 7-day period.</p> <ul style="list-style-type: none"> Level 0: incidence <20/100,000 and <1.5% positivity Level 1: incidence 20–74/100,000 and 1.5–2.9% positivity Level 2: incidence 75–149/100,000 and 3.0–4.9% positivity Level 3: incidence 150–299/100,000 and 5.0–9.9% positivity Level 4: incidence ≥300/100,000 and ≥10.0% positivity
	<p>Level 2</p> <ul style="list-style-type: none"> Restricted outdoor small gathering, some limitations on personal services, events are generally not permitted, limitations to alcohol service and further limitations to business hours. 	
	<p>Level 3</p> <ul style="list-style-type: none"> Most business is are open (except large events, entertainment, no alcohol service), restricted travel and recommended avoidance of public transit, restricted outdoor small gathering, anything indoors significantly restricted, restrictions on college and universities. 	<p>Scotland's metrics and thresholds are subject to change.</p>
	<p>Level 4</p> <ul style="list-style-type: none"> Mass closures (bars, personal service settings, recreation facilities, etc), essential services only, elementary and high schools remain open with significant measures and higher levels of education under restrictive blended measures, restricted use 	

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	of public transit, restricted outdoor small gathering, work from home required.	
	<i>Resilience and Recovery 2020-2021: Plan for Living with COVID-19</i>	Indicators are identified, however thresholds are not quantified.
	Changes between levels are highlighted below.	
	Level 1 (green)	Note: incidence is calculated on 14-day and 7-day cumulative incidence as well as 5-day rolling averages (probably by 100,000 though not clearly stated).
	<ul style="list-style-type: none"> Least restrictive limitations on gatherings, non-essential stores are open with restrictions, and work from home is preferred, but nightclubs remain closed. 	Criteria for assessment will include:
	Level 2 (blue)	<ol style="list-style-type: none"> The number, location and dispersion, and characteristics of cases and clusters, including the extent of secondary/tertiary spread. 14-day and 7-day cumulative incidence, 5 day rolling average of cases by county and nationally. Indicators of viral transmission (including the number of cases, positivity rate(s) and reproduction number) Incidence, protective and outbreak management capacity in at risk settings and vulnerable groups The capacity and performance of the programme of sampling, testing, contact tracing and disease surveillance The capacity and resilience of the health service in terms of: <ul style="list-style-type: none"> Hospital occupancy and new admissions Critical care occupancy and new admissions Numbers of deaths Other measures including infection prevention and control data and uptake of seasonal flu vaccine and the international situation.
United Kingdom (Ireland) – National ⁴⁸	<ul style="list-style-type: none"> Gatherings are further limited, and strict capacities set on businesses, transport restricted to essential workers during peak hours. 	
	Level 3 (yellow)	
	<ul style="list-style-type: none"> Strict limits on visitors in household, gatherings are prohibited indoors, with very small gatherings allowed outdoors, domestic travel is limited to essential reasons, and public transit is restricted at all times to essential workers. Restaurants are closed for indoor service, with limited outdoor dining. 	
	Level 4 (orange)	

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
Czech Republic – National ⁵⁰	<ul style="list-style-type: none"> No visitors allowed to household, closure of cultural venues and entertainment, hotels restricted to essential and existing guests, all non-essential retail closed except if operated primarily outdoors, work from home mandatory, higher education primarily remote. 	
	Level 5 (red)	
	<ul style="list-style-type: none"> Lockdown: Only essential business open, food service by takeout/delivery only, all non-essential businesses closed, domestic travel restricted to 5 km, professional sports cancelled. 	
	<p>Risk assessment at local, regional and national level.</p> <p>The Ministry of Health in the Czech Republic has developed a framework focusing on measures of community transmission. This was published on July 1, 2020.</p>	<p>Note: incidence is cumulative over 7 days per 100,000.</p>
	<p>Level 0 (white)</p> <ul style="list-style-type: none"> No measures outlined. <p>Level 1 (green)</p> <ul style="list-style-type: none"> Basic hygiene measures, face mask optional. <p>Level 2 (yellow)</p> <ul style="list-style-type: none"> Recommend to wear mask in public spaces, limit gatherings, capacity reductions and hours of operation for restaurants, consider work from home. <p>Level 3 (red)</p>	<ul style="list-style-type: none"> Level 0 (white): cumulative number of newly diagnosed patients with COVID-19 in the given area in the past 7 days >25/100,000 Level 1 (green): average daily increase in the number of positive cases in the past 7 d is 50% higher compared to the average of the previous 7 days Level 2 (yellow): 7 day increase in proportion of cases over the age of 65 exceeding 50% Level 3 (red): proportion of hospitalized COVID-19 cases exceeding 2% of active cases <p>Czech uses a score-based system where the incidence and other indicators are measures that when met give one point to the score. Based on the tally of points, a final level is</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<ul style="list-style-type: none"> Limit contact with others and only go outside when required, use PPE, have supplies on hand for 14 days, limit gatherings and schools (consider remote learning), limited access to services. 	assigned. Therefore, transition between levels is not solely based on incidence measures.
Belgium – National ⁴⁹	<p>COVID-19 Control Tower</p> <p>Approximately mid-October or earlier the control tower model was introduced.</p> <p>A summary of public health measures of each alarm level was not found in the rapid search conducted for this review.</p>	<p>Note: incidence is assessed at national and provincial level over 14 days (cumulative) and the framework focuses on incidence per 100,000.</p> <ul style="list-style-type: none"> No alarm: no or only a few sporadic infections Pre-alarm phase: 1–14/100,000 Alarm level 1: 15–30/100,000 Alarm level 2: 31–50/100,000 Alarm level 3: 51–100/100,000 Alarm level 4: >100/100,000 <p>Percent positivity and trends in case incidence are taken into account but not quantified.</p> <p>Indicators focus on the epidemiological situation, testing positivity and health care system capacity at the state level.</p>
Australia – National ⁵¹	<p><i>Framework for National Reopening</i></p> <p>Framework uses a traffic light system for managing COVID-19 mitigation measures.</p> <p>Introduced in October, 2020.</p> <p>No associated public health measures were found.</p>	<p>Note: incidence is cumulative of 7 days per 100,000; percent positivity is the average daily percent positivity of testing in the past 7 days.</p> <ul style="list-style-type: none"> Green (maintain, monitor and report): <50 cases reported nationally, incidence <0.2/100,000, <0.25% positivity and 20% probability that $R_e > 1$ Yellow (targeted adjustments needed): 50–100 cases reported nationally, incidence 0.2–0.4/100,000, 0.25–0.50% positivity and 20–49% probability that $R_e > 1$

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
World Health Organization ⁶	<p>The WHO interim guidance on considerations for implementing and adjusting public health and social measures in the context of COVID-19 updated on November 4, 2020 from the original guidance from April 16, 2020 provides a list of indicators for different tiers of community outbreak levels.</p> <p>Each community transmission level will be assigned a situation level. While situation level 0 is not possible based on the matrix provided by WHO, it has been included for completeness. A minimum situation level 1 applies to community transmission level 1; a minimum situation level 2 applies to community transmission level 2 and 3; a minimum situation level 3 applies to community transmission level 4.</p> <p>Situation level 0:</p> <ul style="list-style-type: none"> No restrictions on daily activities; basic hygiene measures in place. <p>Situation level 1:</p> <ul style="list-style-type: none"> Focus on protection of the most vulnerable and advise avoidance of closed spaces, crowded places, and close-contact settings, and additional safety measures for all settings. <p>Situation level 2:</p> <ul style="list-style-type: none"> Work from home encouraged, limit gatherings, further protection of vulnerable populations. 	<ul style="list-style-type: none"> Red (harder, wider, different response): >100 cases reported nationally, incidence >0.4/100,000, >0.50% positivity and >50% probability that $R_e > 1$ <p>The primary epidemiological indicators related to hospitalization rate per 100,000, mortality per 100,000, case incidence per 100,000 and testing percent positivity all over a 14-day period. Additional categories of transmission classification have been provided with labels of no cases, imported/sporadic cases, and clusters of cases. Abstraction has focused on the community transmission.</p> <p>Note: incidence is cumulative rate over 14 days per 100,000.</p> <p>Community transmission level 1:</p> <ul style="list-style-type: none"> Hospitalization rate: <5 Mortality: <1 Case incidence: <20 Testing % positivity: <2% <p>Community transmission level 2:</p> <ul style="list-style-type: none"> Hospitalization rate: 5-<10 Mortality: 1-<2 Case incidence: 20-<50 Testing % positivity: 2-<5% <p>Community transmission level 3:</p> <ul style="list-style-type: none"> Hospitalization rate: 10-<30 Mortality: 2-<5 Case incidence: 50-<150 Testing % positivity: 5-<20% <p>Community transmission level 4:</p>

Jurisdiction	Description of frameworks/approaches	Indicators and thresholds
	<p>Situation level 3:</p> <ul style="list-style-type: none"> Closure of non-essential businesses or remote working as much as possible, consider limits on in-person education for adult learning, strict rules about professional sports and restrictions on other events and gatherings. <p>Situation level 4:</p> <ul style="list-style-type: none"> Stay at home measures, essential workers only, closure of most businesses, and blended strategies for maintaining education for children. 	<ul style="list-style-type: none"> Hospitalization rate: ≥ 30 Mortality: ≥ 5 Case incidence: ≥ 150 Testing % positivity: $\geq 20\%$ <p>Numerous other epidemiological indicators are described including their limitations: ICU proportional occupancy, R_e, doubling time, proportion of unlinked cases amongst new cases, overall test positivity, influenza-like illness or severe acute respiratory infection trends, all-cause hospitalization rate trends, and all-cause (excess) mortality trends. Health system and public health system capacity indicators are also listed, but are out of scope for this review.</p>

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