METROWEST HEALTH FOUNDATION

# Demystifying Public Health Terms and Metrics

A quick reference guide in the era of COVID19

## Prevalence vs. Incidence

The Massachusetts Department of Public Health (MA DPH) has been sharing the total number of COVID19 cases each week broken down by community, which gives us a sense of how many cases have occurred since the pandemic began. The state has also been sharing average daily incidence rates, which tells us how quickly cases are adding to the total within a community.

These concepts are sometimes referred to as prevalence and incidence. One way to think about these concepts is with this example: if you plug a sink and turn on the tap, the water pooling in the bottom represents prevalent cases; this water is measurable and clearly visible to us. The "new" water flowing from the tap represents incidental cases, and the rate of incidence can change as you adjust the flow of the tap. Knowing the incidence or the prevalence alone does not provide a complete picture about how quickly the virus is spreading, but together, the metrics can help describe risk to the population at large.

## Vulnerability vs. Susceptibility

Oftentimes these terms are used interchangeably, but they do have nuanced meaning. It can help to think of vulnerability as a function of exposure; front-line and essential workers are more vulnerable than the rest of the population because they experience more points of exposure to the virus. Susceptibility relates to the response to that exposure; people with underlying health conditions may suffer more intensely from the virus compared to people without underlying health conditions. Each of us have varying degrees of vulnerability and susceptibility to different types of illnesses depending on our lifestyle and medical history.

| | **Low susceptibility** | **High susceptibility** |
|---|---|---|
| **Low vulnerability** | Healthy person working from home | Cancer survivor practicing social distancing |
| **High vulnerability** | ER nurse without underlying conditions | Grocery store worker with diabetes |

## Understanding Risk Color Categories in Massachusetts

MA DPH uses color coding to indicate risk in communities. By the state's definition, if there are fewer than 5 *total cases* reported, then a community is in the "gray" category. If there are fewer than 4 *cases per 100,000 people*, the community is in the green category (the yellow and red categories are also based on rates). The difference between the gray and green categories is that

green refers to a rate, and gray refers to a count. Two communities can have the same average daily incidence rate but have different total case counts based on the size of their population. The rate per 100,000 is a simple calculation used in many public health situations to help us understand incidence across different sizes of populations:

Rate per 100k = (# cases / population size) * 100,000

From this formula, we can derive the total number of cases:

# cases = (Rate per 100k / 100,000) * population size

MA DPH has been publishing an average daily incidence rate based on cases in a two-week time span. We can think of Average Daily Incidence as the number of new cases per day, on average, a community sees in a 14 day period.

Average Daily Incidence = (# cases in 14 days / 14 days)

An example of two communities with the same incidence rate is shown below:

| | Average Daily Incidence Rate per 100k over 14 days | Population size | Average Daily Incidence (ADI) of cases over two weeks<br><br>[(Rate per 100k/ 100,000) * population size] | ADI * 14 = How many total cases occurred over the two week time span |
|---|---|---|---|---|
| Community A | 2.85 | 10,000 | 0.285 (about one case every 3-4 days) | 4 |
| Community B | 2.85 | 20,000 | 0.57 (about one case every 1-2 days) | 8 |

Community A would be coded as Gray, while Community B would be coded as Green, despite having the same Average Daily Incidence Rate.

*Caution*: Rates help us compare incidence between communities of different sizes, but this calculation does not indicate anything about the demographics, susceptibility, or vulnerability of the people with the virus.

## Positivity Rates and Testing

Testing rates are another way that public health practitioners understand spread of a virus. In a perfect world, an accurate, inexpensive, non-invasive test with quick processing turnaround would be available for every person. By looking at the positivity rate – meaning, out of all the tests, what percent returned positive – we could understand how widespread the virus is, regardless of whether people show symptoms. Because a single test for the virus acts as a snapshot, indicating a positive or negative for the point in time that the person was tested, virus testing would also be paired with antibody testing to see if there is evidence that a person previously fought the virus.

A perfect world eludes us, but we can use widespread testing as a tool to help us grasp prevalence. When testing for a virus, a higher positivity rate indicates greater prevalence in a population. Sometimes greater prevalence via testing can be perceived as progress, because identifying positive

cases can help us understand the symptoms (or lack thereof) of the disease and limit spread by encouraging quarantining. It's also important for helping sick people get appropriate care. At the same time, a higher positivity rate indicates more sick people, assuming the tests are accurate.

Earlier in the pandemic, MA DPH reported the positivity rate based on the number of positive tests per total persons tested. If someone took two tests and received one negative and one positive result, that person would add 1 to the numerator (positive tests) and 1 to the denominator (persons tested). That changed in mid-August and the state now reports the positivity rate based on the number of positive tests per total tests taken. The same person from the previous example, using the new method, would add 1 to the numerator (positive tests) and 2 to the denominator (tests taken), resulting in a lower positivity rate. While both are accurate, it is important to understand how these metrics are presented and consider how testing bias, accuracy, and availability come into play.

## Hospitalization Rates

When available, hospitalization rates can be useful in monitoring the severity and spread of a virus and allowing resources to be allocated accordingly. Hospitalization rates are less sensitive to the factors that impact testing rates, assuming that people are willing and able to go to the hospital when they require a higher level of care. MA DPH has published the number of confirmed and suspected COVID19-related hospitalizations as well as the number of cases in intensive care units for hospitals across the state. Observing the total hospitalizations over time can give insight into how quickly the virus is spreading. Average length of stay in a facility and ICU rates offer insight into how severe and long-lasting the impact of the virus is among those who contracted it. A limitation of hospitalization metrics are that they overlook barriers to care that would influence a person's willingness to be hospitalized, such as cultural beliefs or cost restrictions.

## Quick Reference

In summary, the following should be considered when reviewing public health data:

| Metric | It's great because: | But be wary that: |
|---|---|---|
| Average Daily Incidence Rate | It helps us compare how quickly new cases are identified across communities of different sizes | A basic incidence rate does not indicate demographics of the diagnosed cases and does not reflect the susceptibility or vulnerability of the population |
| Testing Positivity Rate | We get a sense for how widespread an illness is | The number alone does not indicate how many total people may have been tested or how many are false positives. It may be more likely to include people who noticed symptoms and decided to get tested, and the metric can be sensitive to the number of tests done. |
| Hospitalization Rate | The public can grasp the severity of an illness and allocate resources to facilities | It will not capture those for whom the illness progressed very quickly or who do not have access to medical care |