## COVID-19 Population Immunity Calculator

This calculator attempts to estimate the true proportion of a population that have immunity against COVID-19. Given just the natural infection rate and vaccination rate, one can estimate the total population immunity against COVID-19 in any region.

Traditional immunity estimates only look at a single metric: vaccination rate. But there are two main issues with this: 1) not all vaccinated individuals are protected (since vaccine efficacy is not 100%) and 2) they do not take into account acquired immunity from those who have previously been infected with COVID-19. This calculator attempts to correct for these two major issues to give a more accurate representation of the total population immunity.

*For more details: covid19-projections.com/path-to-herd-immunity*

*Interactive version here: https://coda.io/@youyanggu/covid-19-population-immunity-calculator*

**How to Use**

1) The spreadsheet is **VIEW ONLY**. To make edits to the values, first make a separate copy for yourself (File >> Make a copy).

2) Edit the 3 cells inside the purple border. The total population immunity calculation will auto-update.

**INPUTS**

| | | Reference: US | |
|---|---|---|---|
| Change values below to match each region | | | |
| Natural infection rate (% already infected) | 35% | ~30-40% | **Total Population Immunity** 65% |
| Total population vaccination rate (with 1+ dose) | 55% | ~55% | |
| Vaccination rate among previously infected individuals | 45% | ~45% | Note: Even if population immunity is at or near herd immunity, local outbreaks are still possible (and even likely given new variants). Even if protection is not 100%, vaccines are near 100% effective at protecting against hospitalizations & deaths. |
| *(should be slightly lower than the total vaccination rate)* | | | |

**EFFICACY CONSTANTS**

| | | |
|---|---|---|
| *These are best estimates based on the latest research, taking into account the variants.* | | |
| Average vaccine efficacy | 85% | |
| Average natural immunity efficacy | 85% | |
| Average vaccine + natural immunity efficacy | 95% | |

**CALCULATIONS**

| | |
|---|---|
| *DO NOT EDIT THE CELLS BELOW. They are used for calculating the total population immunity based on the above inputs. All formulas can be derived with basic algebra.* | |
| Vaccination rate among those with no previous infection | 60% |
| | |
| % vaccinated only (no past infection) | 39% |
| % past infection only (no vaccination) | 16% |
| % both vaccinated and past infection | 19% |
| Total % vaccinated or past infection (sum of prev 3 rows) | 74% |
| | |
| % with immunity via vaccination only | 33% |
| % with immunity via natural infection only | 13% |
| % with immunity via vaccination and natural infection | 18% |
| Total population immunity (sum of prev 3 rows) | 65% |