

A New Forecast of Total Deaths by COVID-19 in the World, US and Countries of South America (May-04-2020)

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In previous article we report a result on the total deaths in a country by COVID-19 which resulted in 100% of population's deaths (Ecuador). This does not seem reasonable. The purpose of this article is to recalculate this value, using a more plausible model.

We will assume in this article that the number of resolved cases by COVID-19 is given by a real function of one real variable, $A(t)$, and follows an exponential behavior of the form $A(t) = A_0 b^t$, $A_0, b \in \mathbb{R}$, where the time t is measure in days. The number of resolved cases will be the number of recovered cases plus the number of deaths, both by the COVID-19 pandemic in a same date. This is yet a preliminary mathematical model, that follows a geometric progression of ratio b , value b calculated using only the first two dates registered, i.e., $b = \frac{A(t=1)}{A(t=0)}$. Looking at the graph available for the number of confirmed cases on the Johns Hopkins University website, it is possible to see that the most recent behavior of this pandemic has been linear, rather than exponential.

Then we asked the following questions:

1) When an entire population will have been infected by the coronavirus, in this COVID-19 pandemic, and your case will be solved (dead or recovered), assuming that no vaccination or other form of preventive (or curative) medication exists until that day, and the population remains constant (births and other deaths are not accounted for)? We also assume that no change in social behavior or health procedures occurs until that date, so that the ratio b is constant, for simplicity.

2) What will be the total number of deaths by COVID-19 on that date?

Here we are interested only in data from the world as a whole, the United States of America and the countries of South America. The results are shown in tables 1 and 2 next. Date zero was considered May 03, 2020.

We use in the tables

Confirmed Cases 1, Deaths 1, Recovered 1 and Resolved Cases 1 as the number of Confirmed Cases, Deaths, Recovered and Resolved Cases of May-04-2020, respectively, and

Confirmed Cases 2, Deaths 2, Recovered 2 and Resolved Cases 2 as the number of Confirmed Cases, Deaths, Recovered and Resolved Cases of May-03-2020, respectively.

Summarizing the table 2, in approximate values, the world will have the number of resolved cases equal to the current population in 12 months, the USA in 10 months, Brazil in 6 months and Uruguay in 5 years and 6 months (a great exception for the world, obviously). On average, complete resolution of cases by COVID-19 in a country will take place in about 11 months (around April 2021), not counting Guyana (no new cases of contamination and deaths).

Table 3 suggests that the COVID-19 pandemic will be the most terrible pandemic we have ever had, which I certainly hope is not. Nevertheless, Uruguay, Paraguay, Venezuela, Guyana and Suriname recorded no deaths.

The number of deaths is calculated using the lethality percentage, which was calculated by dividing deaths by the number of cases resolved on date $t = 1$. With this new calculation, the number of deaths estimated for Ecuador is 5,595,282 (32.15 % of the population), instead of 17,398,970 (100 % of the population).

All primary data on COVID-19 was extracted from the Johns Hopkins University website, while data on population was extracted in pages

<https://countrymeters.info/en/World> and
https://countrymeters.info/en/South_America,

in May/04/2020.

| Type | Confirmed Cases 1 (t = 1) | Confirmed Cases 2 (t = 0) | Deaths 1 (t = 1) | Deaths 2 (t = 0) | Recovered 1 (t = 1) | Recovered 2 (t = 0) |
|-----------|---------------------------|---------------------------|------------------|------------------|---------------------|---------------------|
| Time | 6:32:29 AM | 6:32:27 AM | 6:32:29 AM | 6:32:27 AM | 6:32:29 AM | 6:32:27 AM |
| Date | May 04-2020 | May 03-2020 | May 04-2020 | May 03-2020 | May 04-2020 | May 03-2020 |
| Country | | | | | | |
| World | 3.519.901 | 3.444.236 | 247.744 | 244.084 | 1.129.834 | 1.099.866 |
| US | 1.158.341 | 1.133.069 | 67.682 | 66.385 | 180.152 | 175.382 |
| Brazil | 101.826 | 97.100 | 7.051 | 6.761 | 42.991 | 40.937 |
| Peru | 45.928 | 42.534 | 1.286 | 1.200 | 13.550 | 12.434 |
| Ecuador | 29.538 | 27.464 | 1.564 | 1.371 | 3.300 | 2.132 |
| Chile | 19.663 | 18.435 | 260 | 247 | 10.041 | 9.572 |
| Colombia | 7.668 | 7.285 | 340 | 324 | 1.722 | 1.666 |
| Argentina | 4.783 | 4.681 | 246 | 237 | 1.354 | 1.320 |
| Bolivia | 1.594 | 1.470 | 76 | 71 | 166 | 159 |
| Uruguay | 655 | 652 | 0 | 0 | 442 | 440 |
| Paraguay | 396 | 370 | 0 | 0 | 126 | 119 |
| Venezuela | 357 | 345 | 0 | 0 | 158 | 148 |
| Guyana | 82 | 82 | 0 | 0 | 22 | 22 |
| Suriname | 10 | 10 | 0 | 0 | 9 | 8 |

Table 1 – Confirmed cases, deaths and recovered cases by Covid-19 in 05/04/2020 and 05/03/2020. Thousands separator is point (.).

| Type | Resolved Cases 1 (t = 1) | Resolved Cases 2 (t = 0) | Resolved Cases Ratio | Population | Estimative for all population be Resolved Case (days) | Lethality % |
|-----------|--------------------------|--------------------------|----------------------|---------------|---|-------------|
| Time | 6:32:29 AM | 6:32:27 AM | 6:32:29 AM | 6:38:32 AM | 6:32:29 AM | 6:32:29 AM |
| Date | May 04-2020 | May 03-2020 | May 04-2020 | May 04-2020 | May 04-2020 | May 04-2020 |
| Country | | | | | | |
| World | 1.377.578 | 1.343.950 | 1,0250 | 7.795.459.713 | 351 | 17,98 |
| US | 247.834 | 241.767 | 1,0251 | 333.716.821 | 292 | 27,31 |
| Brazil | 50.042 | 47.698 | 1,0491 | 217.221.942 | 176 | 14,09 |
| Peru | 14.836 | 13.634 | 1,0882 | 33.435.005 | 92 | 8,67 |
| Ecuador | 4.864 | 3.503 | 1,3885 | 17.401.183 | 26 | 32,15 |
| Chile | 10.301 | 9.819 | 1,0491 | 18.896.776 | 158 | 2,52 |
| Colombia | 2.062 | 1.990 | 1,0362 | 50.579.609 | 285 | 16,49 |
| Argentina | 1.600 | 1.557 | 1,0276 | 45.645.408 | 378 | 15,38 |
| Bolivia | 242 | 230 | 1,0522 | 11.561.943 | 213 | 31,40 |
| Uruguay | 442 | 440 | 1,0045 | 3.487.448 | 1.980 | 0,00 |
| Paraguay | 126 | 119 | 1,0588 | 7.080.343 | 192 | 0,00 |
| Venezuela | 158 | 148 | 1,0676 | 33.291.761 | 188 | 0,00 |
| Guyana | 22 | 22 | 1,0000 | 780.361 | 0 | 0,00 |
| Suriname | 9 | 8 | 1,1250 | 568.191 | 95 | 0,00 |

Table 2 – Estimative in days for that all population be resolved case and lethality percentage in complete contamination by COVID-19 in the world, US and countries of South America. Origin of time (t = 0) is 05/03/2020. Decimal point is comma (.). Thousands separator is point (.).

| Type | Population | Estimative for all population be Resolved Case (days) | Lethality % | Deaths |
|-----------|---------------|---|-------------|---------------|
| Time | 6:38:32 AM | 6:32:29 AM | 6:32:29 AM | 6:38:32 AM |
| Date | May 04-2020 | May 04-2020 | May 04-2020 | May 04-2020 |
| Country | | | | |
| World | 7.795.459.713 | 351 | 17,98 | 1.401.937.583 |
| US | 333.716.821 | 292 | 27,31 | 91.136.091 |
| Brazil | 217.221.942 | 176 | 14,09 | 30.606.928 |
| Peru | 33.435.005 | 92 | 8,67 | 2.898.181 |
| Ecuador | 17.401.183 | 26 | 32,15 | 5.595.282 |
| Chile | 18.896.776 | 158 | 2,52 | 476.960 |
| Colombia | 50.579.609 | 285 | 16,49 | 8.339.994 |
| Argentina | 45.645.408 | 378 | 15,38 | 7.017.981 |
| Bolivia | 11.561.943 | 213 | 31,40 | 3.631.023 |
| Uruguay | 3.487.448 | 1.980 | 0,00 | 0 |
| Paraguay | 7.080.343 | 192 | 0,00 | 0 |
| Venezuela | 33.291.761 | 188 | 0,00 | 0 |
| Guyana | 780.361 | 0 | 0,00 | 0 |
| Suriname | 568.191 | 95 | 0,00 | 0 |

Table 3 – Deaths number estimative in the world, US and countries of South America in complete contamination by COVID-19. Decimal point is comma (.). Thousands separator is point (.).