

## **Forecast of Total Deaths by COVID-19 in the World, US and South America (May-01-2020)**

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Continuing our study relative to a new mathematical modeling of coronavirus contamination, we will assume in this article that the number of infected by COVID-19, given by a real function of one real variable,  $A(t)$ , 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. Similarly, the number of deaths follows another function  $C(t) = C_0 d^t$ ,  $C_0, d \in \mathbb{R}$ , and again, of course, the time  $t$  is measure in days. This is a preliminary mathematical model that follows geometric progressions of ratios  $b$  and  $d$ , respectively.

We asked the following questions:

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

2) What is the corresponding 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 April 30, 2020. The symbol  $\infty$  represents the infinite number of days, the case that there is never complete contamination.

We use

Confirmed Cases 1 as the number of Confirmed Cases of May-01-2020,  
Confirmed Cases 2 as the number of Confirmed Cases of April-30-2020,  
Deaths 1 as the number of Deaths by COVID-19 of May-01-2020,  
Deaths 2 as the number of Deaths by COVID-19 of April-30-2020.

Summarizing the table 1, in approximate values, the world will have a complete contamination in 13 months, the USA in 7 months, Brazil in just 3 months and Venezuela in 5 years and 3 months (an great exception

for the world, obviously). On average, complete contamination by COVID-19 in a country will take place in about 12 or 13 months (around May or June 2021), not counting the countries with infinite values (Suriname, in this case).

According table 2, except countries with zero lethality (Uruguay, Venezuela, Paraguay, Guyana, Suriname), Argentina and Chile have the lowest percentages of lethality in the countries analyzed, including the world as a whole, and Ecuador has the worst (unfortunately 100 % of population would die in 21 months, certainly by some failure in this simplified model).

Table 2 suggests that the COVID-19 pandemic will be the most terrible pandemic we have ever had, which I certainly hope is not.

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/pt/World> and <https://countrymeters.info/pt/South America>, both accessed in 05/01/2020.

Type	Confirmed Cases 1 (t = 1)	Confirmed Cases 2 (t = 0)	Contamination Ratio	Population	Complete Contamination Forecast (days)
Time	7:32:24 AM	6:32:25 AM	7:32:24 AM	Morning in São Paulo	7:32:24 AM
Date	May 01-2020	April 30-2020	May 01-2020	May 01-2020	May 01-2020
Country					
World	3.271.961	3.206.333	1,0205	7.794.917.435	385
US	1.070.032	1.040.488	1,0284	333.696.220	206
Brazil	87.187	79.685	1,0941	217.205.746	88
Peru	36.976	33.931	1,0897	33.431.397	80
Ecuador	24.934	24.675	1,0105	17.398.970	628
Chile	16.023	15.135	1,0587	18.895.125	125
Colombia	6.507	6.211	1,0477	50.575.545	193
Argentina	4.428	4.285	1,0334	45.641.532	282
Bolivia	1.167	1.110	1,0514	11.560.466	185
Uruguay	643	630	1,0206	3.487.352	422
Venezuela	333	331	1,0060	33.287.934	1.912
Paraguay	266	249	1,0683	7.079.569	155
Guyana	82	78	1,0513	780.338	184
Suriname	10	10	1,0000	568.147	∞

Table 1 – Forecast in days of complete contamination by COVID-19 in the world, US and South America. Origin of time (t = 0) is 04/30/2020. Decimal point is comma (,).

Type	Deaths 1 (t = 1)	Deaths 2 (t = 0)	Deaths Ratio	Complete Contamination Forecast (days)	Forecast Number of Deaths	Lethality %
Time	7:32:24 AM	6:32:25 AM	7:32:24 AM	7:32:24 AM	7:32:24 AM	7:32:24 AM
Date	May 01- 2020	April 30- 2020	May 01- 2020	May 01- 2020	May 01- 2020	May 01- 2020
Country						
World	233.688	227.958	1,0251	385	3.208.540.947	41,16
US	63.019	60.999	1,0331	206	50.279.532	15,07
Brazil	6.006	5.513	1,0894	88	10.275.058	4,73
Peru	1.051	943	1,1145	80	5.642.923	16,88
Ecuador	900	883	1,0193	628	17.398.970	100,00
Chile	227	216	1,0509	125	107.648	0,57
Colombia	293	278	1,0540	193	7.217.679	14,27
Argentina	218	214	1,0187	282	40.032	0,09
Bolivia	62	59	1,0508	185	562.396	4,86
Uruguay	0	0	0,0000	422	0	0,00
Venezuela	0	0	0,0000	1.912	0	0,00
Paraguay	0	0	0,0000	155	0	0,00
Guyana	0	0	0,0000	184	0	0,00
Suriname	0	0	0,0000	∞	0	0,00

Table 2 – Forecast of number of deaths and lethality percentage in complete contamination by COVID-19 in the world, US and South America. Origin of time (t = 0) is 04/30/2020. Decimal point is comma (,).