Beyond Deaths per Capita: Comparative CoViD-19 Mortality Indicators
Suplementary Information: An Example Brazil), part B

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This file and associated Word document illustrate the calculations of the indicators for Brazil based on 1/1/2021 data updates

Fixed demographic parameters (Part B in Technical Appendix)

Section 1 Mid-2020 Population Size

1.1 From the source https://population.un.org/wpp/Download/Standard/CSV/
Get the file for Total Population, All variants
Keep the estimates for 2020, medium variant, all countries

Example For Brazil, 1 number (in thousands)

Total population, 2020 212559.409

1.2 From the source https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/
Determine date of first CoViD-19 death for UN countries and territories

Example For Brazil, 1 date (month/day/year)

Date of first death 3 17 2020

1.3 From the source https://population.un.org/wpp/Download/Standard/CSV/
Get the file for Population by Age and Sex, Medium variant, annual from 1950 to 2010
Keep the estimates for 2020, all countries

Example For Brazil, 2 vectors

Males, 2020	7404.646	7464.84	7623.386	8253.31	8685.557	8534.004	8571.684	8593.722
Females, 2020	7070.447	7136.977	7319.056	7964.694	8466.492	8418.59	8576.223	8735.133

1.3.a From the source https://population.un.org/wpp/Download/Standard/CSV/
Get the file for Population by Age and Sex, Medium variant, annual from 1950 to 2010
Keep the estimates for 2020, all countries

Example For Brazil, 2 numbers

Male infants, 2020 1468.3

Female infants, 2020 1402.62

1.3.b Get children 1-4 from children 0-4 & infants

Example For Brazil, 2 numbers

Males 1-4, 2020	5936.346							
Females 1-4, 2020	5667.827							
1.3.c	Get population 5-74 in 10-year age groups							
Example	For Brazil, 2 vectors							
Males 5-84, 2020	15088.226	16938.867	17105.688	16298.25	12892.572	9931.736	5745.946	2402.447
Females 5-84, 2020	14456.033	16431.186	16994.813	16691.918	13731.053	11134.693	6992.176	3406.893
1.3.d	Get population 85+							
Example	For Brazil, 2 numbers							
Males 85+, 2020	627.405							
Females 85+, 2020	1214.414							
Section 2	Calendar-Year-2020 Period Life Table Values							
2.1	From the source https://population.un.org/wpp/Download/Standard/CSV/							
	Get the file for Life Table, Medium variant							
	Keep the estimates for lx & ex, periods 2015-20 & 2020-25, all countries							
Example	For Brazil, 8 vectors							
lx, males, 2015-20	1.00E+05	98579.735	98335.619	98198.045	98026.349	97196.061	95892.45	94701.252
lx, females, 2015-20	1.00E+05	98822.813	98621.471	98537.678	98404.742	98183.564	97899.232	97581.555
lx, males, 2020-25	1.00E+05	98798.839	98588.303	98467.29	98313.245	97554.476	96344.713	95227.117
lx, females, 2020-25	1.00E+05	98997.945	98823.323	98749.266	98629.531	98426.818	98162.535	97864.354
ex, males, 2015-20	71.899	71.9336	68.1082	63.2001	58.3064	53.7796	49.4757	45.0666
ex, females, 2015-20	79.272	79.2152	75.3739	70.4359	65.5276	60.6693	55.838	51.0113
ex, males, 2020-25	73.012	72.8987	69.0509	64.1327	59.2293	54.6672	50.3212	45.8825
ex, females, 2020-25	80.1448	79.9552	76.0938	71.149	66.2324	61.3633	56.5215	51.6858
2.1.a	Get npx from lx							
Example	For Brazil, 4 vectors (10 values for x=0, 1, 5, 15, 25, 35, 45, 55, 65 & 75)							
npx, males, 2015-20	9.86E-01	9.98E-01	9.97E-01	9.78E-01	9.74E-01	9.64E-01	9.33E-01	8.68E-01
npx, females, 2015-20	9.88E-01	9.98E-01	9.98E-01	9.95E-01	9.92E-01	9.84E-01	9.64E-01	9.22E-01
npx, males, 2020-25	9.88E-01	9.98E-01	9.97E-01	9.80E-01	9.76E-01	9.66E-01	9.37E-01	8.76E-01
npx, females, 2020-25	9.90E-01	9.98E-01	9.98E-01	9.95E-01	9.93E-01	9.85E-01	9.66E-01	9.27E-01
2.1.b	Get npx for 2020 from npx for 2015-20 & npx for 2020-25							
Example	For Brazil, 2 vectors							
npx, males, 2020	9.87E-01	9.98E-01	9.97E-01	9.79E-01	9.75E-01	9.65E-01	9.35E-01	8.72E-01
npx, females, 2020	9.89E-01	9.98E-01	9.98E-01	9.95E-01	9.92E-01	9.85E-01	9.65E-01	9.25E-01

2.2

2.2.a Get nmx from lx & ex

Example For Brazil, 4 vectors (11 values for x=0, 1, 5, 15, 25, 35, 45, 55, 65, 75 & 85)

nmx, males, 2015-20	1.44E-02	6.20E-04	3.15E-04	2.20E-03	2.61E-03	3.71E-03	6.88E-03	1.41E-02
nmx, females, 2015-20	1.19E-02	5.10E-04	2.20E-04	5.15E-04	7.90E-04	1.59E-03	3.65E-03	8.07E-03
nmx, males, 2020-25	1.21E-02	5.33E-04	2.79E-04	2.02E-03	2.44E-03	3.48E-03	6.44E-03	1.31E-02
nmx, females, 2020-25	1.01E-02	4.41E-04	1.96E-04	4.75E-04	7.42E-04	1.50E-03	3.43E-03	7.53E-03

2.2.b Get nmx for 2020 from nmx for 2015-20 & nmx for 2020-25

Example For Brazil, 2 vectors

nmx, males, 2020	0.01326754	0.00057671	0.00029717	0.00210824	0.00252603	0.00359544	0.00665761	0.01356478
nmx, females, 2020	0.01100635	0.00047573	0.00020812	0.00049471	0.00076566	0.00154808	0.0035403	0.0078015

Updated Mortality Indicators (Part A in Technical Appendix)

Section 1 *CCDR*

1.1 From the source https://coronavirus.jhu.edu/

Get current estimate date & cumulative number of covid-19 deaths

Keep the estimates for all UN countries and territories

Example For Brazil, 1 number & 1 date (month/day/year)

Death estimate	194949		
Date of estimate	1	1	2021

For USA 1 number & 1 date (month/day/year)

Death estimate	345737		
Date of estimate	1	1	2021

1.2 From fixed demographic indicators

Get date of first CoViD-19 death and total mid-2020 population size for all locations in (1.1)

Example For Brazil, 1 number (in thousands) & 1 date (month/day/year)

Total population, 2020	212559.409		
Date of first death	3	17	2020

For USA, 1 number (in thousands) & 1 date (month/day/year)

Total population, 2020	331002.647		
Date of first death	3	2	2020

1.3 Calculate exposure in person-years for all locations in (1.1)

Example For Brazil, 1 number (in thousands)

Person-years	169002								
	For USA, 1 number (in thousands)								
Person-years	276740								
1.4	Calculate the estimated period Crude Covid-19 Death Rate (*CCDR*) for all locations in (1.1)								
Example	For Brazil, 1 number (in deaths per thousand person-years)								
CCDR	1.15352968								
Section 2	*CCMR*								
2.1	From the source https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku								
	Get report date and number of reported covid-19 deaths by sex and age group								
Example	2 vectors & 1 date (month/day/year)								
Male deaths	22	11	32	292	1332	3620	9748	23104	
Female deaths	10	8	19	191	755	1778	4746	12877	
Date of estimate	12	30	2020						
2.2	From fixed demographic indicators								
	Get the mid-2020 population size by age groups for all locations in (1.1)								
Example	For Brazil, 2 vectors (in thousands)								
Males by age group, 2020	1468.3	5936.346	15088.226	16938.867	17105.688	16298.25	12892.572	9931.736	
Females by age group, 202	1402.62	5667.827	14456.033	16431.186	16994.813	16691.918	13731.053	11134.693	
	For USA, 2 vectors (in thousands)								
Males by age group, 2020	2039.37	8015.693	21023.906	22157.053	23846.969	20977.453	20288.634	20751.951	
Females by age group, 202	1951.448	7669.821	20110.733	21344.6	23040.84	20932.937	20342.971	21459.462	
2.3	Calculate age-and-sex-specific covid-19 death rates for the USA								
Example	For USA, 2 vectors (in deaths per thousand person-years)								
Male rates	0.01478763	0.00188115	0.00208645	0.0180652	0.07656724	0.23655262	0.65861963	1.52616046	
Female rates	0.00702449	0.0014298	0.00129508	0.01226641	0.04491802	0.11643232	0.31980504	0.82256044	
2.4	Calculate estimated counterfactual numbers of covid-19 deaths for all locations in (1.1)								
Example	For Brazil, 2 vectors								
Female deaths by age grou	17.2633594	8.8788082	25.029871	243.298299	1041.34693	3065.35408	6751.28026	12051.3935	
Male deaths by age group	7.83369941	6.44325327	14.8853377	160.250029	606.944377	1545.22488	3491.41165	7282.12236	
2.5	Calculate the Comparative Covid-19 Mortality Ratio (CCMR) for estimated numbers of covid-19 deaths for all locations i								
Example	For Brazil, 1 number (in deaths per thousand person-years)								
CCMR	1.56700864								
Section 3	Estimated Reduction in 2020-Life Expectancies								

3.1 From fixed demographic indicators

Get period life-table age-specific death rates (nmx) and survival probabilities (npx) for year-2020 for each country in (1.1)

Example	For Brazil, 4 vectors							
npx, males, 2020	0.98689226	0.99769634	0.99703248	0.97910377	0.97504726	0.964638	0.93535103	0.87212003
npx, females, 2020	0.9891034	0.99809934	0.9979207	0.99506403	0.99236928	0.98462455	0.96513929	0.92453186
nmx, males, 2020	0.01326754	0.00057671	0.00029717	0.00210824	0.00252603	0.00359544	0.00665761	0.01356478
nmx, females, 2020	0.01100635	0.00047573	0.00020812	0.00049471	0.00076566	0.00154808	0.0035403	0.0078015

3.2 Calculate the age-specific ratio of updated to previously projected deaths from all causes in 2020 for each country in (1.1)

Example	For Brazil, 2 vectors							
nRx, males	1.00138135	1.00406304	1.0087466	1.01066705	1.03772699	1.0818541	1.12292859	1.13942177
nRx, females	1.00079169	1.00374383	1.00775227	1.03088616	1.07306933	1.09364783	1.11238789	1.1309569

3.3 Calculate age-specific survival probabilities in the new projected year-2020 life table for each country in (1.1)

Example	For Brazil, 2 vectors							
*npx, males	0.98687427	0.99768699	0.99700656	0.97888324	0.97411816	0.96179945	0.92769792	0.85564043
*npx, females	0.98909482	0.99809223	0.9979046	0.99491197	0.991814	0.98319684	0.96129813	0.91508011

3.4 Calculate the age-specific number of years lived after age x for individuals dying in the age interval in the new projected yea

Example	For Brazil, 2 vectors							
*nax, males	0.08110658	1.60991325	5.28729479	5.77473421	5.11743064	5.33412189	5.50442983	5.48014364
*nax, females	0.08485635	1.49391652	5.57429439	5.43728791	5.56616648	5.5718189	5.59769645	5.65219385

3.5 Calculate new values of life expectancies ($e_x{}^o$ values) in the year-2020 life table for all locations in (1.1)

Example	For Brazil, 2 vectors							
ex, males	70.8076455	70.7483298	66.9086182	57.0936317	48.2006984	39.3453996	30.6962525	22.65963
ex, females	78.1103825	77.9706461	74.1168248	64.2607503	54.5615767	44.9659637	35.6392228	26.8486949

3.6 Calculate the difference between the new values of life expectancies in year-2020 life table and the original values

Example	For Brazil, 3 vectors							
Diff in ex, males	1.64122072	1.66171283	1.66490029	1.66824885	1.69203454	1.69313261	1.65089297	1.5415536
Diff in ex, females	1.59375157	1.61062505	1.61314637	1.61539917	1.61437525	1.59913747	1.56596075	1.4978324
Diff in ex, both sexes	1.61806504	1.63679196	1.63965448	1.64246852	1.65415196	1.64728132	1.60946262	1.52022618

7704.528	6721.639	6170.933	5508.456	4423.28	3394.482	2351.464	1480.939	921.508	423.007
7956.785	7079.054	6651.999	6089.814	5044.879	4034.221	2957.955	2011.193	1395.7	752.233

93421.833	91887.99	90018.099	87486.788	84010.341	79319.932	72901.013	64131.683	53579.501	40657.012
97128.793	96489.731	95591.475	94181.698	92153.999	89297.819	84964.87	78829.755	70191.912	58246.853
94018.919	92566.322	90795.125	88400.322	85115.544	80684.01	74603.737	66238.802	56043.892	43307.648
97436.95	96832.354	95982.892	94652.211	92742.5	90056.543	85979.982	80186.326	71961.344	60423.493
40.6489	36.2843	31.9839	27.8333	23.8762	20.1327	16.6737	13.5976	10.7666	8.3748
46.2368	41.5255	36.8907	32.4029	28.0576	23.87	19.9517	16.2986	12.9793	10.1045
41.4392	37.0491	32.721	28.5362	24.536	20.7393	17.2149	14.0595	11.1458	8.6677
46.9009	42.1773	37.527	33.017	28.6424	24.4174	20.4489	16.7351	13.3455	10.3928

7.35E-01	4.99E-01
8.26E-01	6.17E-01
7.51E-01	5.21E-01
8.37E-01	6.35E-01

7.43E-01	5.10E-01
8.32E-01	6.26E-01

3.03E-02	6.63E-02	0.15550407
1.88E-02	4.66E-02	0.12978754
2.81E-02	6.23E-02	0.1505752
1.76E-02	4.39E-02	0.12634398

0.02919471	0.06428998	0.15303963
0.01820512	0.04522272	0.12806576

39437	46138	39811
24917	36506	56317
5745.946	2402.447	627.405
6992.176	3406.893	1214.414
15110.793	7132.609	2441.585
17063.097	9056.327	4244.395
3.57757354	8.86711422	22.3513209
2.00175005	5.52565937	18.1884493
16344.1377	16937.4498	11149.6972
11128.4352	14967.6806	17562.0149

in (1.1)

0.7430472	0.51010334	
0.83152401	0.62587533	
0.02919471	0.06428998	0.15303963
0.01820512	0.04522272	0.12806576
1.15090904	1.16746247	1.1709303
1.13600533	1.14950624	1.1679704
0.7104796	0.45572398	
0.81091875	0.58352773	

r-2020 life table for each country in (1.1)

5.23508467	4.89517641	5.58039632
5.51992621	5.23312565	6.68551905
15.558071	9.76468738	5.58039632
18.8157407	11.9159148	6.68551905
1.38206161	1.18856733	0.95385881
1.38149726	1.24416135	1.12296928
1.38178632	1.21568636	1.03635172

161.001	37.722	5.675
349.826	96.88	15.475

26752.433	14359.584	5872.788	1613.615
43309.775	27310.5	13632.434	4476.96
29206.533	16167.993	6847.801	1951.199
45685.258	29447.489	15089.164	5098.862
6.4307	4.9084	3.6986	2.8377
7.7049	5.7626	4.1402	3.04
6.6412	5.047	3.7801	2.8715
7.9149	5.9015	4.223	3.0747