Beyond Deaths per Capita: Comparative CoViD-19 Mortality Indicators
Suplementary Information: Sensitivity Analysis

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This file illustrates alternate calculations of life expectancy reduction using the actual age distribution for Brazil (from 12/31/2020) and 1/1

Age distribution of CoViD-19 deaths in Brazil

1.1 From the source https://transparencia.registrocivil.org.br/especial-covid
For Brazil, 3 vectors

Male deaths	158	641	971	3316	7474	14634	25672	28900
Female deaths	154	536	849	2245	4453	8813	16502	20343
Unknown deaths	1	39	1	0	5	3	4	10

1.2 From the source https://coronavirus.jhu.edu/
Get current estimate date & cumulative number of covid-19 deaths

Example	For Brazil, 1 number & 1 date (month/day/year)		
Death estimate	194949		
Date of estimate	1	1	2021

1.3 Prorate to the current estimate for males and females
For Brazil, 2 vectors

Male deaths	163	680	997	3403	7672	15018	26345	29660
Female deaths	159	568	872	2304	4571	9044	16934	20878

Directly standardized rate

2.1 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

2.2 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
Example For USA, 2 vectors								
Males, 2020	10055.063	10246.393	10777.513	10834.321	11322.732	12144.455	11702.514	10858.871
Females, 2020	9621.269	9798.759	10311.974	10408.587	10936.013	11690.875	11349.965	10756.92
2.3 Get population by age and sex with same age-groups as Covid-19 deaths from Brazil								
Example For Brazil, 2 vectors								
Males, 2020	14869.486	15876.696	17219.561	17165.406	14426.167	11679.389	7817.762	3832.403
Females, 2020	14207.424	15283.75	16885.082	17311.356	15035.839	12741.813	9079.1	4969.148
For USA, 2 vectors								
Males, 2020	20301.456	21611.834	23467.187	22561.385	20087.681	21021.6	18515.16	10972.505
Females, 2020	19420.028	20720.561	22626.888	22106.885	20260.716	21098.477	19973.01	13110.092
2.4 Get sex- and age-specific rates of death from Covid-19 in Brazil								
Example For Brazil, 2 vectors								
Males, 2020	0.01093808	0.04280015	0.05789299	0.19822148	0.53183196	1.28584541	3.36983562	7.73936137
Females, 2020	0.01115798	0.03717768	0.05162182	0.13306858	0.30401662	0.70980389	1.86519929	4.20156921
2.5 Multiply sex- and age-specfic rates of death from Covid-19 in Brazil by proportion in sex- and age-group in USA								
Example								
Males, 2020	0.00067087	0.00279451	0.00410446	0.01351092	0.03227548	0.08166257	0.18849712	0.25655439
Females, 2020	0.00065464	0.0023273	0.0035288	0.00888734	0.0186089	0.04524369	0.11254787	0.16641244
2.6 Sum across all sex- and age-groups and multiply by one over fraction of year								
Example For Brazil, 1 number								
DSCDR	1.89262081							
Reduction in life expectancy at birth								
3.1 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
3.2 Get npx from lx								
Example For Brazil, 4 vectors (10 values for x=0, 10, 20, 30, 40, 50, 60, 70, 80 & 90)								
npx, males, 2015-20	9.82E-01	9.90E-01	9.74E-01	9.70E-01	9.52E-01	9.07E-01	8.09E-01	6.34E-01
npx, females, 2015-20	9.85E-01	9.96E-01	9.94E-01	9.89E-01	9.76E-01	9.48E-01	8.83E-01	7.39E-01
npx, males, 2020-25	9.85E-01	9.91E-01	9.76E-01	9.72E-01	9.55E-01	9.13E-01	8.21E-01	6.54E-01
npx, females, 2020-25	9.87E-01	9.97E-01	9.94E-01	9.89E-01	9.77E-01	9.51E-01	8.90E-01	7.54E-01
3.3 Get npx for 2020 from npx for 2015-20 & npx for 2020-25								
Example For Brazil, 2 vectors								
npx, males, 2020	9.83E-01	9.90E-01	9.75E-01	9.71E-01	9.54E-01	9.10E-01	8.15E-01	6.44E-01
npx, females, 2020	9.86E-01	9.97E-01	9.94E-01	9.89E-01	9.77E-01	9.50E-01	8.87E-01	7.46E-01
3.4 Get nmx from lx & ex								
Example For Brazil, 4 vectors (10 values for x=0, 10, 20, 30, 40, 50, 60, 70, 80 & 90)								
nmx, males, 2015-20	1.83E-03	1.02E-03	2.60E-03	3.01E-03	4.90E-03	9.74E-03	2.10E-02	4.42E-02
nmx, females, 2015-20	1.48E-03	3.60E-04	6.15E-04	1.12E-03	2.42E-03	5.31E-03	1.24E-02	2.96E-02
nmx, males, 2020-25	1.55E-03	9.30E-04	2.41E-03	2.83E-03	4.59E-03	9.09E-03	1.95E-02	4.13E-02
nmx, females, 2020-25	1.27E-03	3.27E-04	5.73E-04	1.06E-03	2.27E-03	4.96E-03	1.15E-02	2.77E-02
3.5 Get nmx for 2020 from nmx for 2015-20 & nmx for 2020-25								
Example For Brazil, 2 vectors								
nmx, males, 2020	0.0016929	0.00097656	0.00250775	0.00292208	0.00474457	0.00941498	0.02020965	0.04270665
nmx, females, 2020	0.00137368	0.00034345	0.00059398	0.00109197	0.00234504	0.00513461	0.01193996	0.02862141
3.6 Calculate the age-specific ratio of updated to previously projected deaths from all causes in 2020								
Example For Brazil, 2 vectors								
nRx, males	1.00645683	1.04381057	1.02306272	1.06775732	1.11188206	1.13606504	1.16540882	1.17815534
nRx, females	1.00811825	1.10823141	1.08688843	1.12180884	1.12952171	1.13795791	1.15547598	1.14513354
3.3 Calculate age-specific survival probabilities in the new projected year-2020 life table								
Example For Brazil, 2 vectors								
*npx, males	0.983219	0.98983851	0.97467337	0.96925272	0.94848628	0.89803377	0.78756703	0.59523245
*npx, females	0.98632478	0.9962	0.99356399	0.98781731	0.97381497	0.94306847	0.87013866	0.71513706
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	9.76E-01	7.00E+00	4.93E+00	5.29E+00	5.48E+00	5.47E+00	5.44E+00	5.17E+00

*nax, females	8.24E-01	5.73E+00	5.24E+00	5.57E+00	5.72E+00	5.56E+00	5.55E+00	5.45E+00

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

Example	For Brazil, 2 vectors							
ex, males	70.6699538	61.859447	52.4226137	43.6566529	34.8737072	26.4700037	18.8541296	12.4735945
ex, females	78.1512328	69.2233562	59.4655567	49.8168095	40.3625479	31.2941625	22.8475841	15.4298419

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

Example	For Brazil, 2 vectors							
Diff in ex, males	1.77862005	1.80107639	1.79502682	1.81239945	1.78768793	1.70972343	1.57740644	1.35151234
Diff in ex, females	1.5526901	1.56534358	1.54703342	1.52808035	1.48525429	1.41231696	1.29293553	1.08442601
Diff in ex, both sexes	1.66841032	1.68608477	1.67405443	1.67370721	1.64015933	1.5646471	1.43864014	1.22122633

3.7 Difference with difference using CDC sex- and age-specific rates of death from Covid-19

Example	For Brazil, 3 numbers
Diff in diff in ex, males	0.13739933
Diff in diff in ex, females	-0.0410615
Diff in diff in ex, both sexe	0.05034528

3.8 Relative difference with difference using CDC sex- and age-specific rates of death from Covid-19

Example	For Brazil, 3 numbers
% diff in diff in ex, males	7.73%
% diff in diff in ex, female	-2.64%
% diff in diff in ex, both se	3.02%

/2021 data updates

21000	5673	256
19145	7687	495
7	3	0

21552	5822	263
19648	7889	508

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
10118.582	9969.099	10319.535	10702.065	10049.886	8465.274	6645.519	4326.986	2805.623	1538.659
10176.017	10084.699	10258.272	10840.205	10619.257	9353.753	7709.344	5400.748	3655.579	2372.445

1344.515	198.723	5.675
2147.933	446.706	15.475
4344.282	882.134	20.792
6028.024	1795.638	76.312

16.0294873	29.2989751	46.2875686
9.14746233	17.6613084	32.8219826

0.21038083	0.07808283	0.00290756
0.16658816	0.09580986	0.00756704

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

3.53E-01	1.12E-01
4.69E-01	1.64E-01
3.73E-01	1.21E-01
4.87E-01	1.73E-01

3.63E-01	1.16E-01
4.78E-01	1.68E-01

9.74E-02	1.93E-01	0.35239807
7.17E-02	1.59E-01	0.32894737
9.24E-02	1.87E-01	0.34825004
6.82E-02	1.54E-01	0.32523498

0.0948876	0.19023682	0.35032406
0.06997506	0.15641075	0.32709118

1.16258084	1.14240565	1.11378989
1.12710062	1.10591924	1.08734181

0.30797917	0.08573665
0.43521884	0.13951307

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

4.48E+00	3.31E+00	2.56287112

4.93E+00	3.98E+00	2.81167477
7.44056406	4.10152939	2.56287112
9.40510835	5.21245068	2.81167477
1.07858502	0.87534353	0.29162883
0.84187688	0.61890552	0.24557677
0.96311764	0.75025182	0.26916441

161.001	37.722	5.675

349.826	96.88	15.475
703.131	179.003	20.792
1348.005	447.633	76.312

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