
COVID-19: Emerging Trends

Actuarial & Economic Perspectives

April 2nd, 2020

Ibrahim Muahnna, MD & Actuary
Michael Muhanna, Senior Manager & Actuary
David Robalino, PhD Chief Economist

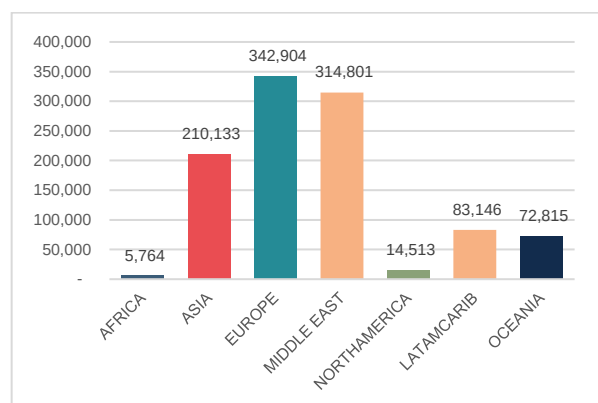
info@muahnna.com | muahnna.com



1. Introduction

The world is going through a health and economics crisis of unprecedented scope that will leave marks for many years to come. The pandemic is spreading fast across continents and has now reached low income countries. We have over eight hundred thousand cases worldwide and forty thousand deaths;¹ WHO estimates deaths will exceed 100 thousand over the coming days and weeks. In terms of cases per capita the situation in middle and low-income countries is already looking grim. And, because testing is not widespread, the real number of cases is likely to be orders of magnitude higher.

FIGURE 1 COUNTS OF INFECTIONS BY REGION



Policies to control the spread of the virus are also imposing severe economic costs. In the absence of cures or vaccines, Governments are struggling to “flatten the curve” through “social distancing” policies. These policies, however, are affecting employment and productivity and contributing to a major contraction of the world economy. Like in the case of the 2007-2009 financial crisis, even with the right policies, going back to normal is likely to take years.

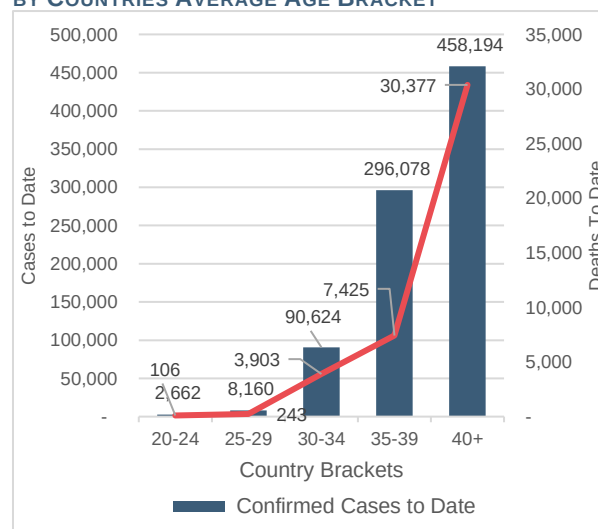
The number of studies modeling the epidemic and/or trying to identify the best responses has been growing rapidly.² Actuaries have been debating alternative ways to assess the risks associated with the virus, not only in terms of impacts on the assets and liabilities of pension funds but also the mortality and morbidity rates affecting the social protection systems and the

insurance industry. There are also several analyses about how the pandemic is likely to affect our economies and the tradeoffs between interventions that protect lives and others that protect incomes and jobs.

This note takes stock of the latest data on the number of cases and deaths around the world, coupled with basic economic and demographic indicators and discusses, broad, emerging trends.

The analysis shows that the health impact of Covid-19 will depend on the level of development of the country and the age structure of the population. The number of deaths per capita is likely to be higher in countries with older demographics, less developed health systems and state capabilities, and lower average incomes for households to cope with the impacts of the pandemic. Even after controlling for income levels and demographics, countries in Africa and Latin America seem to be particularly vulnerable.

FIGURE 2 TOTAL REPORTED CASES & DEATHS TO DATE BY COUNTRIES AVERAGE AGE BRACKET



There are some short-term and long-term policy implications.

- **Over the short-term, it is imperative to have a better grasp of the real number of cases in the population and credible estimates of mortality rates by age/gender groups.** Without this information governments are navigating blind. Countries should try to deploy tests to a representative sample of the population and then use standard statistical

¹ As of March 30th, via John Hopkins Data)

² See selected list of references

techniques to infer infections and mortality rates to the entire population.

- **In parallel, countries need to strike the right balance between mitigation/ suppression policies that try to protect people from infection and eventual death, and others needed to mitigate the impacts of an economic recession.** In developing countries, and middle low-income countries in particular, social distancing policies cannot be implemented during a long period of time without, potentially, catastrophic consequences on the economy. It is also not realistic to do so in countries with large informal sectors:
 - *Young workers who are less likely to get sick or die should be allowed to go back to work as soon as possible.*
 - *The priority should be to protect the elderly and those with pre-existing health conditions known to increase the risk of death.* Given capacity constraints in the health system even under normal circumstances, there should be strict gate-keeping policies to ensure that doctors, hospital beds, and inputs are there for those who need them the most. Quarantine policies for at risk groups and mechanisms to ensure they have access to basic goods and services will be critical.
 - *But because damage has already been inflicted, countries need to implement/expand programs to protect jobs and incomes.* At the level of the firm, a place to start is to differ pay-roll and income taxes and social security contributions. Like in the last financial crisis, wage subsidies could also play a role. At the level of individuals, expanding social assistance programs and unemployment benefits is a must. This will require adopting a flexible fiscal stance.
- **Over the long-term, governments and societies at large need to take stock of what has happened and introduce overdue reforms to improve the functioning and expand the coverage of health and social protection systems, to be better prepared in the future.**

2. COVID-19 and Demographic Structures

For this study, we analyzed and tracked confirmed reported cases and deaths related to COVID-19 for

159 countries from January 22, 2020. Instead of looking at the geographic distribution of cases and deaths, we look at the distribution by age groups. Thus, countries have been grouped in 5 age brackets (see Table).

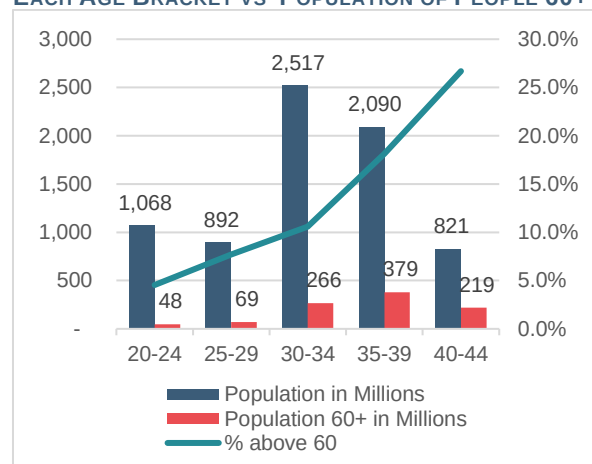
TABLE 1 POPULATION IN MILLIONS OF COUNTRIES IN EACH AGE BRACKET

Age Group Bracket	# of Countries in Bracket	Population of all ages (Millions)		Pop. of 60+ in Millions	
		Count	%	Count	%*
20-24	39	1,068	14%	48	5%
25-29	26	892	12%	69	8%
30-34	35	2,517	34%	266	11%
35-39	22	2,090	28%	379	18%
40+	37	821	11%	219	27%
Total	159	7,388	100%	982	13.3%

*Percentage of the countries' population above the age of 60

Most of the world population, including seniors, is in the middle age brackets. The distribution by population is skewed towards the third and fourth brackets due to the large population of India and China. Furthermore, the 59 countries in the fourth and fifth brackets have 61% of the world population that are 60 and above. There are fewer seniors in the countries in the 40+ bracket compared to the three younger brackets, they make up 27% of the population in their countries (see ascending green line in the figure below).

FIGURE 3 POPULATION IN MILLIONS OF COUNTRIES IN EACH AGE BRACKET VS POPULATION OF PEOPLE 60+



Countries with higher average ages are experiencing higher COVID-19 fatality rates compared to other countries. As of March 30th, both cases and deaths reported were systemically increasing in each of the five groups of countries. The gap between them is increasing as the pandemic evolves. The number of cases rose from 555 on January 22nd to 78,572 on

February 22nd to 336,953 on March 22nd. While the number of deaths rose from 17 on January 22nd to 2,458 on February 22nd to 42,107 on March 31st.

FIGURE 4 TOTAL CASES PER MILLION OF POPULATION

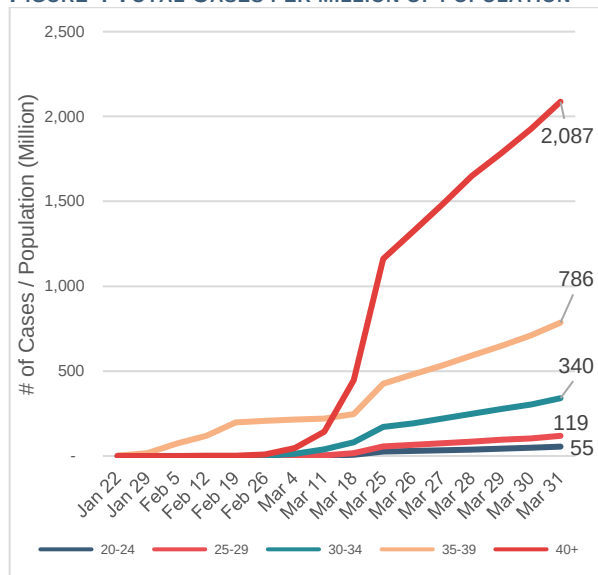
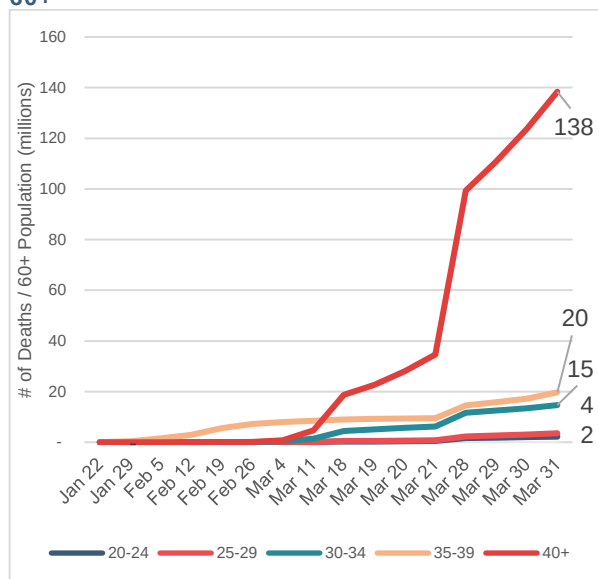


FIGURE 5 TOTAL DEATHS PER MILLION OF POPULATION 60+



While the speed of the spread depends on the effectiveness of several mitigation factors such as social distancing and advanced testing measures, the increase in the number of deaths may be more clearly pronounced among countries with aging societies.

But the worse is still to come in younger countries. The average lag time in days COVID-19 entering countries or delays in reporting in the different brackets varies considerably by age bracket. It is clear that most countries in the 1st & 2nd & 3rd brackets are yet to be hit by the virus.

TABLE 2 LAG TIMES

Age Group Bracket	# of Countries in Bracket	Days first reported Cases	Days first reported Death
20-24	39	17	4
25-29	26	25	7
30-34	35	32	12
35-39	22	39	19
40+	37	41	18
Total	159		

3. How the Pandemic is Likely to Unfold

There are correlations in the data indicating that countries' level of economic development and demographics matter. Simple cross-country regressions show that, other things being equal, death rates decline with the level of GDP per capita and the number of beds per capita, and increase as a function of the average age of the population. Even after controlling for region specific characteristics, these four variables remain statistically significant (see TABLE).

GDP per capita can be considered a proxy for several socioeconomic dimensions: state capability to mitigate the impacts of the pandemic; the share of the population living in urban vs. rural areas; and the resources that households have to mitigate health shocks and cope with them. The results show that a 10% increase in GDP per capita is associated with 70 fewer deaths per one million population or 700 deaths per 10 million population. So is the advantage conferred by higher incomes and better institutions.

The number of beds per capita is a rough proxy for the capacity of the health system to respond to the crisis. Not only in terms of providing treatment to those who become seriously ill, but also in terms of being able to manage caseloads efficiently so that resources are allocated to those who need them the most. But their impact in terms of saving lives is relatively less important, perhaps because access to treatment will not guarantee survival. Thus, an increase of 10 beds per 1,000 population would save only 10 lives per one million population.

The average age is a proxy for the share of the population that is more exposed to the risk of death. As far as we know, the virus is more likely to be lethal for older people. Thus, older countries with a larger share of elderly population and therefore a higher average wage are likely to be more vulnerable. Other things being equal, a

country where the average age is higher by 5 years, would see 3.5 additional deaths per one million population or 35 deaths per 10 million population.

Clearly, the current number of infections per capita, even if underestimated, is the main predictor of the observed number of deaths with a mortality rate of around 2%. Indeed, the results show that 100 additional infections per one million population would lead to 2 additional deaths per one million population. Thus, the main thing that countries can do to reduce the future number of deaths is to control the number of cases. But because the policies that control the number of cases – social distancing – also have impact on jobs and labor

productivity, the optimal might not necessarily be suppressing the virus but only mitigating contagion.

The correlations that have been identified suggest that deaths from the epidemic could range between 150,000 and 445,000 but these are likely to be very conservative estimates. The assumption for these projections is that infection per million population in all countries reach levels ranging from 0.5 to 1.5 times those observed in Italy. But only the United States is predicting to have up to 240,000 deaths. That would imply 41,651 infections per million compared to Italy's 1,613.

TABLE 3: WORLDWIDE CORRELATIONS BETWEEN DEATHS PER 100,000 AND ECONOMIC AND DEMOGRAPHIC FACTORS

Variables	Parameter Value	Standard Error	Parameter Value	Standard Error
Intercept	3.7568	8.086	-2.2476	11.9498
Log (GDP/ capita)	-5.6626**	3.1494	-6.8974**	3.6298
Beds per 1000 pop.	-1.1816**	0.6877	-1.1352*	0.723
Percentage of the population 60+				
Average Age	0.6974***	0.3281	0.7614**	0.4586
Days first reported Cases	-0.2453	0.3191	-0.2066	0.3448
Days first reported Cases (Squared)	0.0052	0.0036	0.0061*	0.0039
Total infection / Total population	0.0256***	0.0032	0.0246***	0.0035
Europe			7.555	5.558
Middle East			8.2504	6.1594
Oceania			5.6074	8.7862
Africa			8.7477**	5.0589
South America			8.0001*	5.1849
North America			-8.4547	11.9706
R Square	0.4009		0.4231	
Number of Observations	159		159	

*** Variables with p-value between 0% and 5%

** Variables with p-value between 5% and 10%

* Variables with p-value between 10% and 15%

ANNEX

A brief tabulation of the 159 countries used in this Policy Note.

FIGURE 4 NUMBER OF COUNTRIES BY AVERAGE AGE OF POPULATION

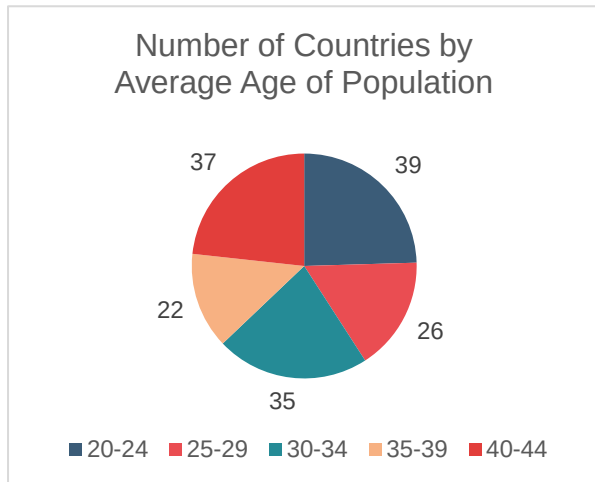


TABLE 4: TOP 5 COUNTRIES REPORTING CASES

Territory	Age Group	Counts to Date		Days since the first count was reported	
		Cases	Deaths	Cases	Deaths
US	35-39	161,807	2,978	69	31
Italy	40+	101,739	11,591	60	39
Spain	40+	87,956	7,716	59	28
Wuhan	35-39	67,801	3,186	99	80
Germany	40+	66,885	645	64	22

It is interesting to note that although the average age of the German population is within the age bracket 40+ and the first case of Covid-19 was reported early on, the first death was reported 42 days later. This may suggest something on the effect of the massive testing that was conducted as well as the readiness of the German health system to cope with COVID-19.

TABLE 5: TOP 10 COUNTRIES REPORTING CASES

Age Group Bracket	159 Countries		Top 10 Countries	
	Death/ 1 m of Pop.	Death/ 1 m of 60+	Ave. Death/ 1 m of 60+	Max. Death/ 1 m of 60+
20-24	0.09	2.04	7	23
25-29	0.23	3.04	8	25
30-34	1.42	13.45	58	333
35-39	3.10	17.07	73	315
40+	33.09	123.98	224	652

TABLE 8 AVERAGE AGE, AVERAGE NUMBER OF BEDS PER 1 MILLION POPULATION & ECONOMIC STRENGTH

Age Group Bracket	Average Age	Number of Beds / Population (Million)	GDP/ capita in Bracket
20-24	22.3	651	1,454
25-29	28.2	1,275	3,151
30-34	32.2	1,415	12,295
35-39	38.3	4,169	29,560
40+	41.9	7,287	26,311
Total	33.1	2,719	13,791

TABLE 9 TOP 5 COUNTRIES IN EACH AGE GROUP BRACKET REPORTING DEATH PER 1 MILLION OF POPULATION 60 AND OVER

Age Gr.	Countries	Population 60+ in (Millions)	Death / 1 m of 60+	Days first reported Death
20-24	Iraq	2.00	23.0	27
	Burkina Faso	0.79	15.1	13
	Gabon	0.12	8.6	11
	Cameroon	1.11	5.4	6
	Mauritania	0.23	4.4	1
25-29	Cabo Verde	0.04	24.8	7
	Honduras	0.70	10.0	5
	Philippines	9.02	8.6	58
	Algeria	4.17	8.4	19
	Jordan	0.60	8.4	4
30-34	Iran	8.28	332.9	41
	Bahrain	0.08	47.7	15
	Panama	0.51	47.4	20
	Dominican Republic	1.16	36.2	14
	Ecuador	1.87	32.2	17
35-39	China (only Wuhan)	10.10	315.3	80
	Luxembourg	0.12	181.2	17
	Ireland	0.94	57.4	20
	US	73.77	40.4	31
	Cyprus	0.23	30.2	9
40-44	Italy	17.79	651.5	39
	Spain	12.02	641.8	28
	Netherlands	4.76	181.6	25
	Belgium	2.92	176.0	20
	France	17.23	175.8	45

References and Key Statistics:

- World Health Organization. "Coronavirus disease (COVID-2019) situation reports." <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>
- Centers for Disease Control and Prevention. "Coronavirus Disease 2019 (COVID-19)." <https://www.cdc.gov/coronavirus/2019-ncov/index.html>
- Doyle, Liam. (2020, March 10). "Coronavirus named: What does COVID-19 stand for?" Express. <https://www.express.co.uk/life-style/health/1241302/Coronavirus-named-COVID-19-meaning-WHO-coronavirus-latest-update>
- Epidemic Calculator: <http://gabgoh.github.io/COVID/index.html>
- Society of Actuaries Research Brief Impact of COVID-19, March 16, 2020, R. Dale Hall, FSA, MAAA, CERA, CFA <https://www.soa.org/resources/research-reports/2020/impact-coronavirus/>
- Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand, Imperial College London, Neil M Ferguson, et al; <https://doi.org/10.25561/77482>
- Is the Imperial College pandemic modelling work 'fit for purpose'? Matthew Edwards FIA; COVID-19 Actuaries Support Group
- Daily Data on Cases & Deaths by country from OCHA & Johns Hopkins (as of March 31, 2020): <https://data.humdata.org/dataset/novel-coronavirus-2019-ncov-cases>
- Static Economic & Population data by Country from UN DATA <https://data.un.org/>

Acknowledgments:

The purpose of the i.e. Muhanna & co. Policy Note Series is to provoke debate and provide a framework for productive policy discussions. This Policy Note was a collaborative effort led by Ibrahim Muhanna, Michael Muhanna, and David Robalino, and other members of the i.e. Muhanna & co teams in Beirut, Nicosia and Dar Es Salaam. Particular thanks are due to Ms. Tassia Tsikkinis, Dr. Twahir Khalfan, Ms. Tala Kammourieh & Ms. Farah Toufaily.

About i.e. Muhanna & co. Ltd:

i.e. Muhanna & co. Ltd, established in 1986, is the oldest independent actuarial and management consulting firm in the region. The company is recognized as the leader of actuarial, economic, and management consulting throughout the Middle East and Africa, assisting governments, organizations and companies to meet their goals.

With more than 30 years of worldwide services, our team of professionals has the capacity to handle sophisticated and specialized tasks with technical expertise and knowledge of local, regional and international needs.

Our keen understanding of the region's language and culture, as well as savoir-faire in technical and strategic issues, allows our firm to provide a wide spectrum of services to private and governmental entities in social insurance, pension and provident funds, employees benefits, health care, life, health and general insurance, rating as well as actuarial education.

Disclaimer

All rights reserved. This report is prepared by i.e. Muhanna & co. Ltd. Although all data in this paper is believed to be as accurate as possible, and has been reviewed and verified, i.e. Muhanna & co. Ltd does not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information disclosed in this Policy Note. Any out-of-context use, by another party, of the information presented herein is not the responsibility of i.e. Muhanna & co. Ltd. Reference herein to any organization, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by i.e. Muhanna & co. Ltd or the author. The views and opinions expressed therein are those of the lead authors and do not necessarily state or reflect those of i.e. Muhanna & co. Ltd.

© All Rights Reserved. i.e. Muhanna & co. Ltd | Cyprus, Lebanon, Tanzania | 2020