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Reducing COVID-19 Deaths: Vaccination of Persons with Comorbidities

Introduction

As the COVID-19 pandemic continues to rage on, a few anti-coronavirus vaccines have completed their Phase 3 trials and have been registered by stringent regulatory authorities. Procurement plans differ from country to country but the Philippines is challenged with prioritizing population groups in order to maximize the vaccination program's impact. Most countries agree that vaccines should prioritize healthcare workers and the elderly; however, the decision to prioritize those with underlying illnesses is less clear. As the burden of NCDs in the country remains high, there is a need to consider this population to mitigate unfavorable COVID-19 outcomes.

Objective

1. To identify how other countries developed their vaccine prioritization roadmap in relation to patients with pre-existing medical conditions.
2. To determine the risk of COVID-19 infection and death among adults with comorbidities.
3. To estimate the prevalence of comorbidities among adult Filipinos and, consequently, the number of additional people who need to be vaccinated.

Recommendations

- It is **strongly recommended to prioritize vaccinating adults with preexisting health conditions** based on their risk for unfavorable COVID-19 outcomes
- Deliberate efforts to include adults with associated comorbidities within an **acceptable and transparent ethical framework or process**.
- As different health conditions vary in severity and risk, it is further recommended to **stratify during prioritization given that risks are confounded by other factors** such as age and occupational context, e.g., being frontline workers.
- If given priority, list adults with associated comorbidities in a **registry for proper accounting and accommodation**.

Methodology

A rapid review of literature was done to determine the frameworks used by other countries in creating a COVID-19 vaccine prioritization plan that maximizes resources economically and benefits ethically. A meta-analysis was used to quantify the risk of severe illness and death from COVID-19 for people with such comorbidities. A modeling study was used to determine the rates of comorbidity in the Philippine population. **This analysis was limited only to adults between the ages of 20-59 years old.** One of the US FDA registered vaccines is indicated only for persons >18 years old; on the other hand, Filipinos >=60 years old are already in the DOH's 2nd and 3rd priority groups.

Results & Discussion

A. Vaccine Prioritization in Other Countries

a. Countries who have opted to procure COVID-19 vaccines have begun to implement their own vaccine prioritization roadmaps. Various countries have noted that healthcare workers and the elderly are prioritized in receiving the vaccine. A rapid review of the prioritization strategies of the USA, Canada, India, Japan, Indonesia, United Kingdom, Germany and France was done. **At the time of writing of this document, it was noted that these countries would broadly include persons with associated comorbidities in their prioritization. This is particularly so in Europe[1].**

Table 1. Summary table of country vaccine prioritization plans

Country	Priority-Setting Process	Prioritization of Comorbidities
North America		
Canada	On deciding who to vaccinate first, the government looked at various criteria including: • age, in terms of those more at risk of complications and death from COVID-19, • **comorbidities or underlying health conditions,** • professions where people are in contact with those who are potentially sick and finally • people in a position to transmit the illness to others	Yes, but ranking is not specified
USA	Federal government has not fully weighed in, but CDC has made recommendations. Each state will likely implement their own prioritization strategies.	Before making an official recommendation, ACIP considered four groups to possibly recommend for early COVID-19 vaccination if supply is limited: • Healthcare personnel • Workers in essential and critical industries • **People at high risk for severe COVID-19 illness due to underlying medical conditions** • People 65 years and older **(These are likely taken together)**
Europe		
France	France relies on a group of advisory committees which have been issuing draft guidelines for vaccination priority. Expert panel of the Haute Autorité de Santé or French National Authority for Heath.	Health and social care workers, risk groups for severe COVID-19 disease. As of November 30, an initial vaccine plan will target those in long-term care facilities, including residents and healthcare workers with associated risks. **Has more granular prioritization arranged in 5 phases. And these are in order of priority and include persons with comorbidities.**
Germany	A committee from the German Ethics Council, the Leopoldina (National Academy of Sciences) and the Permanent Vaccination Commission at the official public health agency, the Robert Koch Institute, has been asked to draw up guidelines for "fair and orderly access"	Elderly Healthcare workers (Other priorities currently still under development.)

1 https://www.ecdc.europa.eu/sites/default/files/documents/Overview-of-EU_EEA-UK-vaccination-deployment-plans.pdf

Italy	Information is sparse	By order of priority: Healthcare workers Elderly **People with comorbidities** Military and Police
Spain	Health Ministry and Interior Ministry work together. Information is sparse.	"first priority group: residents and staff of care homes, other healthcare workers and people with serious disabilities who are not in a care facility, for a total of around 2.5 million individuals."
United Kingdom	Has a joint commitee on vaccinations. Notes flexibility in the order of prioritization.	By order of priority: People in care homes People 80 and over Healthcare workers People over 75 People over 70 **People over 16 who are extremely clinically vulnerable** (cancer patients, patients with organ transplants and severe lung conditions) **16-67 with underlying health conditions** People over 60s People over 50s
Asia		
India	An expert panel with the Centre's health ministry and an expert panel of the Central Drugs Standard Control Organisation (CDSCO) is in charge of prioritization. "The Centre noted that it has already collected the required data on the priority groups from government and private health facilities and have begun feeding into Co-WIN, a digital platform for real-time monitoring of COVID-19 vaccine delivery.	COVID-19 vaccine should be distributed **first in three groups:** health care workers frontline workers, including the police, armed forces, and disaster management volunteers people above the age of 50 years and **those under 50 with comorbidities**
Japan	Ministry Decision information is sparse	First priority is the elderly **The ministry will decide which chronic diseases should be covered** by the planned preferential treatment and whether to establish priority based on age after consulting with experts. Healthcare workers to be deliberated on a later date
Indonesia	National Vaccination Program information is sparse	Priority Groups (in order) : 1. Frontline workers (healthcare, paramedics, military and law enforcement) 2. Community leaders and local authorities 3. Teachers 4. Government officials and legislative council members 5. General public - **no mention of those with comorbidities**

The main rationale to include this group is that **they are at increased risk for severe disease and death due to COVID19.** Prioritization of this group however tends to come with some variability. The United Kingdom, for example, has disaggregated those with underlying conditions according to severity and age[2]. For example, they would put people in the age of 16-70 with underlying health conditions' as a group in itself. It is currently observed that countries are dynamically developing

2 Fauster, Laura. https://www.bbc.com/news/av/health-55153322.

their own prioritization strategies as the days progress. Many countries have their own agencies in charge of vaccine prioritization. Data on individual processes for these countries is limited. It remains to be seen whether or not legitimacy concerns will be encountered among these nations. **For now, a dynamic process of prioritization appears to be acceptable to most countries given the COVID-19 pandemic situation.**

B. The Risk of Severe or Fatal COVID-19 Outcomes among People with Comorbidities

A total of 16,110 patients from 9 different countries were pooled to compute aggregate risk estimates for selected comorbidities. This meta-analysis examined which chronic comorbidities were risk factors for severe COVID-19 disease, ICU admission, or death (Table 1)[3]. Having a chronic respiratory-related disease and hypertension had the highest risk for severe disease, RR = 4.2 and 3.0, respectively. Although ICU admission and death was highest for those with cerebrovascular disease (CVD), RR = 20.2 and 13.3, respectively, the risk estimates had wide uncertainties, probably because of the small number of patients with CVD outcomes. For overall risk across the three sub-outcomes, people with respiratory, cardiovascular, hypertensive, and chronic kidney diseases all have greater than three times the overall risk of a severe or fatal COVID-19 outcome compared to those without such underlying conditions. In addition, an ecologic study of 185 countries found that non-communicable DALYs were correlated to COVID-19 cases and deaths[4].

Table 1. Summary of Comorbidity and its Associated Risks to COVID-19 among Adult Filipinos

	Risk of Severe Disease		Risk of ICU Admission		Risk of Death		Overall Risk	
Comorbidity	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Chronic Respiratory Disease	4.17	2.67 - 6.50	3.32	2.55 - 4.32	4.06	1.77 - 9.31	3.56	2.87 - 4.41
Hypertension	2.75	2.08 - 3.64	5.34	1.52 - 18.71	3.45	2.23 - 5.34	3.17	2.46 - 4.08
Cardiovascular Disease	3.05	2.26 - 4.11	2.97	2.40 - 3.68	5.92	2.66 - 13.19	3.13	2.65 - 3.70
Chronic Kidney Disease	2.37	1.05 - 5.37	3.04	2.19 - 4.23	7.73	1.29 - 46.18	3.02	2.23 - 4.08
Cerebrovascular Disease	2.24	1.26 - 3.98	20.2	2.34 - 174.44	13.27	0.71 - 249.04	2.74	1.59 - 4.74
Malignancy	2.88	1.64 - 5.06	1.72	0.50 - 5.87	3.16	1.15 - 8.70	2.73	1.73 - 4.21
Diabetes Mellitus	2.73	1.95 - 3.82	2.98	1.49 - 5.98	2.08	1.38 - 3.15	2.63	2.08 - 3.33
Obesity	2.29	1.22 - 4.29	-	-	1.15	0.98 - 1.34	1.72	1.04 - 2.85
Chronic Liver Disease*	1.15	0.64 - 2.07	1.69	0.47 - 6.09	8.64	0.50 - 148	1.54	0.95 - 2.49

**Relative risks are non-significant for chronic liver disease.*

C. Prevalence of Comorbidities in the Philippines

In the Philippines, some of these comorbidities are among the highest disease burdens as measured by disability-adjusted life years (DALY). Cardiovascular disease accounts for 7.5% of the burden in the Philippines and has a 3.1x risk of severe or fatal COVID-19 outcome (Figure 1).

3 Zhou Y, Yang Q, Chi J, Dong B, Lv W, Shen L, Wang Y. Comorbidities and the risk of severe or fatal outcomes associated with coronavirus disease 2019: A systematic review and meta-analysis. Int J Infect Dis. 2020 Oct;99:47-56. doi:

4 Azarpazhooh, M. R., Morovatdar, N., Avan, A., Phan, T. G., Divani, A. A., Yassi, N., Stranges, S., Silver, B., Biller, J., Tokazebani Belasi, M., Kazemi Neya, S., Khorram, B., Frydman, A., Nilanont, Y., Onorati, E., & Di Napoli, M. (2020). COVID-19 Pandemic and Burden of Non-Communicable Diseases: An Ecological Study on Data of 185 Countries. Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association, 29(9), 105089. https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105089

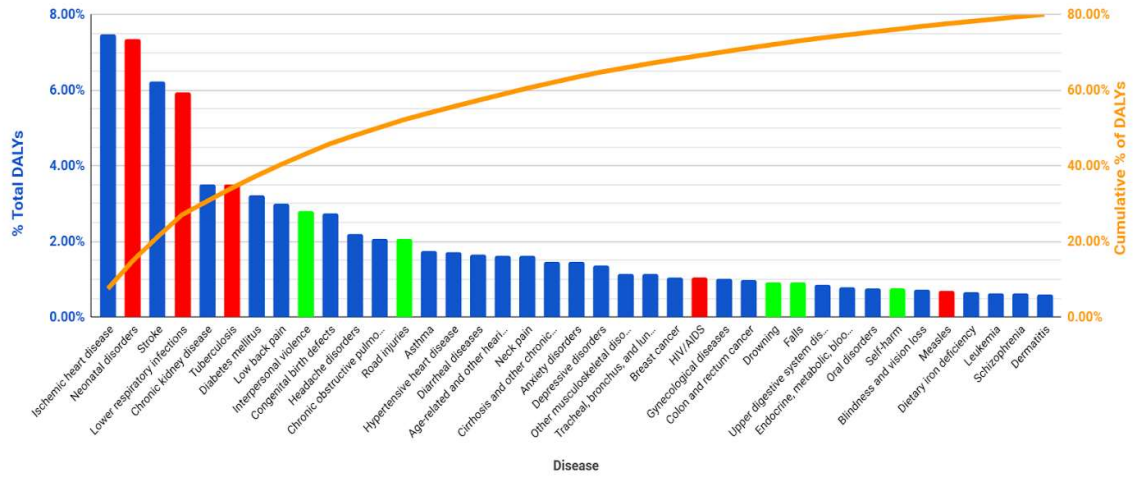

Figure 1. Top 39 Diseases comprising 80% of total Disability-Adjusted Life Years (DALYs) in the Philippines, 2019[5] [Legend: blue: NCDs, red: CDs, green: injuries]

Similarly, other high-risk comorbidities also have high prevalences in the Philippines (Table 2). For example, chronic kidney disease and diabetes are prevalent in 7.7% and 6.3% of adult Filipinos, respectively. We expect that COVID-19 will aggravate the number of severe and fatal COVID-19, with many adult Filipinos experiencing the dual burden of communicable and noncommunicable disease.

Table 2. Prevalence of single and multiple underlying conditions[6]

Age Categories	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	Overall (%)
Population (millions) for mid-year 2020	10.1	9.48	8.25	7.25	6.55	5.76	5.12	4.25	56.76
Mono-Morbidity									
Cardiovascular diseases	0.9%	1.1%	1.3%	1.7%	3.2%	4.2%	5.3%	6.6%	2.5
Chronic kidney diseases	3.4%	5.7%	7.8%	9.0%	9.5%	10.0%	10.6%	11.2%	7.7
Chronic respiratory diseases	1.6%	1.9%	2.2%	2.6%	3.1%	3.7%	4.5%	5.8%	2.8
Chronic liver disease	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%	0.5%	0.4%	0.3
Diabetes mellitus	2.4%	3.7%	4.9%	6.4%	8.0%	9.5%	10.7%	11.4%	6.3
Cancers with direct IS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Cancers with possible IS	0.1%	0.2%	0.3%	0.5%	0.6%	0.7%	0.8%	0.8%	0.4
HIV/AIDS	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1
Tuberculosis (active)	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.4
Chronic neurological disorders	0.8%	0.8%	0.7%	0.6%	0.5%	0.5%	0.5%	0.6%	0.7
Sickle cell disorders	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Multimorbidity (2+ conditions)	0.8%	1.4%	2.1%	3.2%	4.8%	6.8%	9.5%	13.1%	4.2
% of age group population with 1+ underlying condition	10.6%	15.3%	20.1%	24.9%	30.6%	36.5%	43.0%	50.5%	25.4

5 Wong, J & Fowler, KC. (2020). The Philippine Burden of Disease 2019. [manuscript in preparation]

6 Clark, A & Jit, M & Warren-Gash, Charlotte & Guthrie, Bruce & Wang, HHX & Mercer, Stewart & Sanderson, C & McKee, M & Troeger, C & Ong, KL & Checchi, F & Perel, Pablo & Joseph, S & Gibbs, HP & Banerjee, A & Eggo, RM & COV, Centre. (2020). Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study. 8.

D. Population risk estimates of severe COVID-19 due to underlying health conditions

A modelling study was recently done using the IHME Global Burden of Disease Study (2017) to estimate the number of Filipino adults at increased risk of severe COVID-19 due to underlying comorbidities[7]. In this study, it was noted that estimates of at-risk adult populations were highly dependent on the prevalence of chronic kidney disease, diabetes, cardiovascular disease, and chronic respiratory disease. All of these are high-burden diseases in the Philippines. Hence, a large proportion (25.6%) of the adult population is at an increased risk due to having at least one comorbidity (Table 3). In addition, 2.6M (or 4.6%) of the adult population are at high risk of being hospitalized if infected (Table 4). As age increases, the proportion of at-risk population per age group tends to increase. For the oldest age-groups with at least one comorbidity, about 90% of them will be at increased- or high-risk of severe COVID-19. Moreover, the highest proportion of those at increased-risk of severe COVID-19 can be found among the working population of the country (See Fig 2)[8]. The health burden of COVID-19 can impact the economy of the country, as the workforce population is at increased risk of severe infection.

Table 3. Adult population at increased risk of severe COVID-19 due to underlying comorbidities

Number of Underlying Conditions	Adult Population (%)	Adult Population (millions)
0 underlying conditions	74.35	42.2
1 underlying conditions	21.32	12.1
2+ underlying conditions	4.23	2.4
1+ underlying conditions (increased risk)	25.55	14.5

Table 4. Adult population at high risk of hospitalization if infected

Sex	Adult Population (%)	Adult Population (millions)
Males	3.00	1.70
Females	1.59	0.90
Total	**4.58**	**2.60**

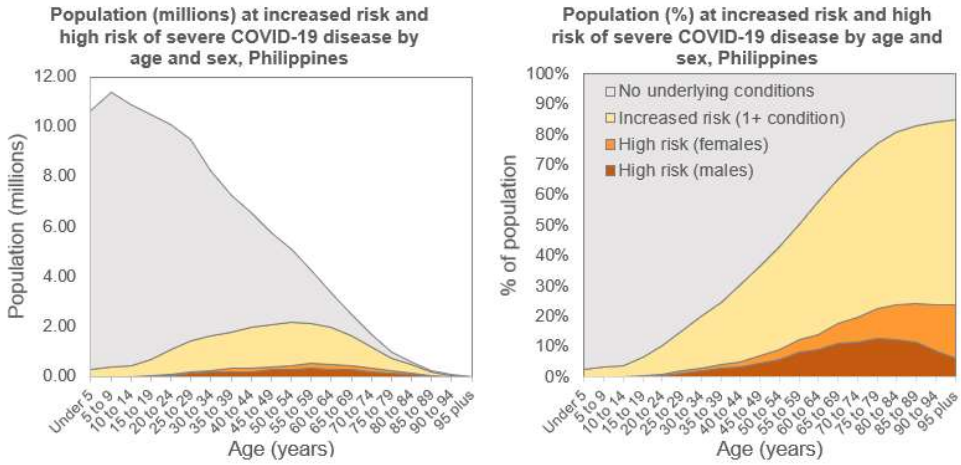

Figure 2. Age-adjusted projections of at-risk populations for severe COVID-19 in the Philippines

[7] Ibid.

[8] Ibid.

Recommendations

1. **The decision to include adults with preexisting health conditions is strongly recommended based on their risk for unfavorable COVID-19 outcomes.** Given that around 25.5% of the adult population is at an increased-risk of COVID-19 due to comorbidities, the country needs to mitigate the fatal outcomes among this group. Otherwise, we expect catastrophic health and economic consequences. They should not be completely excluded in the priority list.

2. **Efforts to include adults with associated comorbidities should be deliberated within an acceptable and transparent ethical framework or process.** A dynamic process may be acceptable given that other countries seem to do the same with a certain degree of transparency.

3. As different health conditions vary in severity and risk, **stratify further during prioritization** given that risks are confounded by other factors such as age and occupational context, e.g., being frontline workers.

4. **If given priority, adults with associated comorbidities should be listed in a registry for proper accounting and accommodation.**

Conclusion

The Philippines has a prioritization roadmap that excludes adults with associated comorbidities who are at increased risk of severe COVID-19 disease and mortality. Other countries have begun planning and implementing their prioritization strategy to include these at-risk groups. The Philippines has a prevalence of around 26% of adults with associated COVID-19 comorbidities that puts them at serious risk for death or severe disease should they be infected with SARS-COV2.

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