GROUP OF TWENTY

G-20 SURVEILLANCE NOTE—ONLINE ANNEX

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TECHNICAL ANNEX: CALCULATIONS OF LIVES SAVED FROM VACCINE SHARING

1. This Annex describes the methodology underlying the results shown in Figure 11 of the main text. Several countries have purchased more COVID-19 vaccines than required to vaccinate their adult populations, while many others will not even be able to cover their high-risk populations this year. This Annex describes the methodology employed to estimate the number of lives that could be saved globally with surplus vaccine donations allowing for an earlier vaccination of high-risk individuals globally. The necessary parameter values for the analysis are highly uncertain, including for the path of the pandemic, number of high-risk individuals, and infection fatality ratios. As such, the approach below rests on simple and transparent assumptions and seeks to provide an assessment of the order of magnitudes of the number lives that could be saved through early vaccine sharing.

A. Overview of the Model

2. A model resting on simple and transparent assumptions is developed to estimate the potential number of deaths that could arise from future waves of infections under two vaccination scenarios.

- *Baseline scenario.* Countries access vaccines only through contracts that have already been signed with manufacturers and COVAX as of May 26.
- V*accine sharing scenario.* Countries that are projected to accumulate surplus vaccine courses by end-2021 are assumed to start sharing vaccines as soon as 50 percent of their population is fully vaccinated, after which local vaccination roll-out is expected to slow markedly and vaccine surpluses expected to accumulate.

3. Under each scenario, the analysis is performed at the monthly frequency through end-2021. There are five country groups globally: (i) advanced economies; (ii) *China*; (iii) *India*; (iv) other emerging market economies (i.e., excluding *China* and *India*); and (v) low-income countries. Thus, the number of lives saved is calculated by month at the country group level as the difference in the potential number of deaths under the baseline and the vaccine sharing scenario. To account for uncertainty, the model is estimated under several different assumptions for the key parameters.

B. Main Assumptions

4. To estimate the model, assumptions are made for the evolution of the pandemic and future COVID waves. Until June 2021, reported number of cases per million inhabitants are based on data from Our World In Data (OWID), aggregated at the country group level. Possible future waves of infections are assumed to be exogeneous and based on simple assumptions about possible paths for the virus in each country group.

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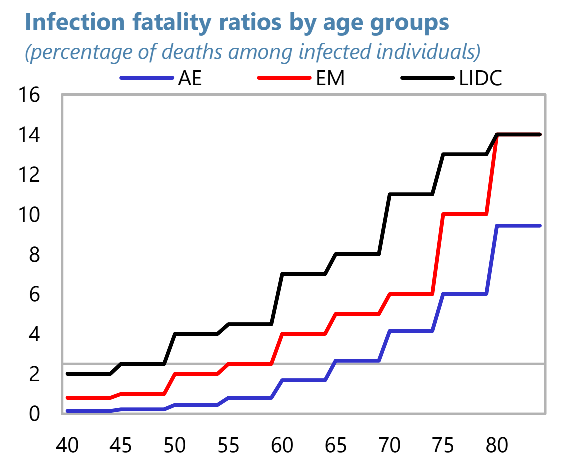
- *Advanced economies and China*. The number of infections per million inhabitants is projected to remain low in China, and to be about twice as low as the minimum number of new infections per people observed in June 2020 on average in advanced economies.
- *India*. The current wave of infections is assumed to peak in July and abate through mid-Fall 2021.
- *Other emerging market economies and low-income countries*. COVID-19 waves are projected to mimic the 2020/21 winter wave observed in advanced economies, with similar shape but higher severities, including to adjust for potential under-measurement of past cases in advanced economies and lower capacity in other emerging market economies and low-income countries to enforce lockdowns. Future waves are projected to peak between July 2021 and January 2022 in emerging market economies (excluding *India* and *China*), and between August 2021 and January 2022 in low-income countries. For *India*, other emerging market economies, and low-income countries, the number of new infections per million people is projected to peak at levels varying between the peak of the average winter 2021 wave in advanced economies and up to five time as high as that average. For comparison, the U.S. wave of infection in the winter 2021 was twice as severe as that in the average advanced economy.

5. **For each country group, assumptions are made for a number of variables**.

- *Number of high-risk individuals*. Age-specific infection fatality ratios are based on Walker and others (2020) and Hogan and others (2020) in which observed shares of age groups are adjusted for healthcare system constraints (Figure 1). High-risk populations are defined as those facing a relatively higher risk of death following infection (above 2.5 percent). Based on UN data on country-specific populations' age distribution and using modeled infection fatality ratios in which older populations are at higher risk of death from infections, 1.4 billion individuals globally are estimated to face a high risk of death if infected with the virus causing COVID-19.

Figure 1. Risk of Death Following Infection



Source: Adapted from Walker and others (2020) and Hogan and others (2020).

- *Infection fatality ratios*. Within each country group, high-risk individuals face a unique infection fatality ratio, equal to the weighted average infection fatality ratio across age groups, within the high-risk populations. The exercise makes use of modelled infection fatality ratios for two main reasons: (i) there are large uncertainties around the reported number of cases and deaths in most countries; and (ii) these take into account the impact of potential healthcare system bottlenecks during large infection waves, which have been shown to increase death risks significantly. Only high-risk individuals are assumed to face a non-zero risk of death following infection.
- *Probability of infection*. Each month, high-risk individuals face a probability of infection equal to the assumed number of new infections per hundred individuals at the country group level. The

projected number of deaths is then calculated at the month-country group level by multiplying the number of high-risk individuals that remain unvaccinated with the probability of infection and the infection fatality ratio.

- *Vaccines*. The model has one type of vaccine, with 100 percent efficacy (i.e., the death risk from fully vaccinated individuals is zero). Monthly vaccine availability reflects the number of full vaccine courses that can be delivered and administered (both first and the second shots for two-dose vaccines). Vaccine surpluses are defined as the number of full vaccine courses available after 50 percent of the population has been fully inoculated within the country group. Vaccines are assumed to be given to high risk individuals first within each country group.

6. Two scenarios are considered for vaccine availability.

- *Baseline scenario.* Vaccine availability projections are from Airfinity, which aggregates all publicly available contracts between vaccine manufacturers and countries to project vaccine availability at the country level through the end of the year.
- *Vaccine sharing scenario.* The baseline scenario is modified as follows: vaccine surplus countries share all additional courses after vaccinating 50 percent of the population to a global vaccine pool. Each month, vaccine surpluses are then allocated to country groups that have yet to finish vaccinating their high-risk populations, proportionally to the number high-risk individuals that remain unvaccinated.

7. To account for uncertainties around the value assigned to model parameters, each parameter is altered separately and the model re-run. For each country group, the number of high-risk individuals, the infection fatality ratio, and the timing and severity of potential future waves of infections are changed. This results in a total of close to one thousand model simulations.

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