TECHNICAL REPORT

Demand and supply of hospital beds, ICU beds and ventilators in Brazil due to COVID-19 pandemics: regional impacts weighted by age structure, the age profile of infection and age-specific risk of hospitalization

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Executive Summary

- This report simulates the supply and demand of hospital beds and ICU beds as well as ventilators by health micro regions in Brazil, taking into account potential increasing demand due to COVID-19 pandemics.

- Our results may support public interventions to prevent further negative consequences of COVID-19 and help health officials design effective actions during the pandemics.

- Our estimates take into account differences in age structure across health micro regions.

- The estimates also consider differences in the age-profile of infection and age-specific risk of hospitalizations (general and ICU) based on USA data.

- Simulations are based on five levels of SARS-Cov-2 infection rates (0.01%, 0.1%, 1%, 10%, 20% e 40%) and two diffusion horizons: short term (1, 3 and 6 months) and medium term (6 and 12 months).

- The use of varying infection rates and diffusion scenarios allows each region to reach saturation of the health supply over different points in time.

Main Findings

Hospitalization (General):

- The saturation of hospitals beds would start when the infection rate by SARS-Cov-2 reached 1% of the population.

- For lower levels of population infection (0.01% e 0.1%), supply would adequately accommodate the demand for hospital beds due to COVID-19 in all regions, regardless of the diffusion horizon.

- Under a 1% of infection rate scenario, the ability of each region to absorb the additional demand would differ, depending on the timing by which its population was infected.

- Under a 1% infection rate distributed over six months all regions would respond to the demand adequately.

- If the same level of infection were, instead, reached in 1 month, 48 health regions (11%) would be operating beyond their capacity. Among these 48 regions, 12 are located in the North, 32 in the Northeast, 2 in the Southeast, and 2 in the Center-West.

Hospitalization (ICU beds)

- Even under an optimistic scenario, many health micro regions would be operating beyond their capacity.

- If the 0.1% of infection rate scenario occurred in 1 month, the number of health micro regions operating beyond their capacity would be as high as 192 (44%). Around 47% of them have no ICU beds available, either public or private which is expected due to economy of scale in healthcare.

- The presence of contiguous regions without adequate numbers of ICU beds renders an additional challenge for the principal municipality of the macroregion to meet the extra demand from its neighboring localities.

- The worst-case scenario occurs when the infection rate reaches 1% in 1 month. This scenario would lead to a collapse of the health system insofar as 53% of micro regions would operate beyond its capacity.

- These findings are particularly alarming, since the supply of ICU beds is key in the recovery of most aggravated COVID-19 cases.

Ventilators

- Although less severe than the scenario for ICU beds, the supply of ventilators to be used by more severe cases of COVID-19 is not ideal.

- Regardless of the scenario, micro regions with a deficit of ventilators would be concentrated in the North and Northeast of Brazil.

- If the infection rate reached 1% in 6 months, 26% of micro regions would be operating beyond their capacity, putting in risk the ability to treat most severe cases of COVID-19.

- If the infection rate reached 1% in 1 month, the proportion of health regions operating beyond its capacity for ventilators would increase to 38%.

(4) Main Limitations

- The diffusion and duration of pandemics in Brazil and in each health micro region are still hard to predict.

- The estimation of the demand for hospitalizations (general and ICU) and ventilators by age group was based on USA parameters and, therefore, needs future assessment.

- Figures do not consider differential diffusion of SARS-Cov-2 by the presence of slums or household size and composition in Brazil. Coresidence of risk group individuals (such as the elderly and individuals with morbidities associated with risk of COVID-19 complications) with individuals with a lower risk of complications and higher risk of being asymptomatic (children, the youth and young adults) may impact infection rates and their regional and time distribution. The actual impact would further depend on public policies to curb new cases, such as social distancing.

- The estimated number of hospital beds (general and ICU) and ventilators available to assist patients with COVID-19 was based on an average occupation rate of the Brazilian Unified Health System as of 2019 for hospital and ICU beds for each health microregion. Because information was unavailable, this rate was used as a proxy to estimate the supply of beds in private hospitals.

- The supply of hospital beds and ventilators was held fixed in this study, regardless of the additional demand due to the COVID-19 pandemics. Our analysis does not consider relocation of hospitalizations due to elective surgery or the creation of new beds or ventilators in response to increased demand.

- The data used to estimate hospital beds and ventilators may be underestimated, especially for hospital beds. Our figures, therefore, are likely to predict a slightly higher load over the health system than actual.

- Estimates do not include the difference in supply by hospital size and economy of scale.

- Finally, the impact of additional demand for beds and ventilators due to COVID-19 on the supply of health professionals and medical supply to make ends meet was not included in our scenarios.

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Link to full report (in Portuguese): https://geesc.cedeplar.ufmg.br/analise-de-demanda-e-oferta-de-leitos-hospitalares-gerais-uti-e-equipamentos-de-ventilacao-assistida-no-brasil-em-funcao-da-pandemia-do-covid-19/