Beyond Symptoms Alleviation: Population-level Benefits of COVID-19 Oral Direct-acting Antiviral (DAA) Treatment and Resulting Decreases in Infectivity and Transmission

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Chacon-Araya M[1], Ortendahl JD[2], Lee J[2], Broder M[2], Brusky S[1]

[1]Pardes Biosciences, Inc., Carlsbad, CA, United States; [2]PHAR, LLC, Beverly Hills, CA United States

Background

- Coronavirus disease (COVID-19) is an unprecedented, persistent global health emergency accounting for over 6.8 million deaths in total, and over 150,000 new cases every day worldwide.[1]
- Efforts to combat COVID-19 have largely focused on vaccination and non-pharmaceutical interventions to reduce transmission and decrease hospitalization and death.[2]
- First generation COVID-19 direct-acting antivirals (DAAs) are only authorized for high-risk individuals to reduce individual risk of disease progression. However, DAAs can also impact transmission by reducing viral load, thereby shortening the duration of infectivity.[3,4]
- Next generation oral DAAs in development may have safety profiles that are amenable to broader eligibility and use.[3]

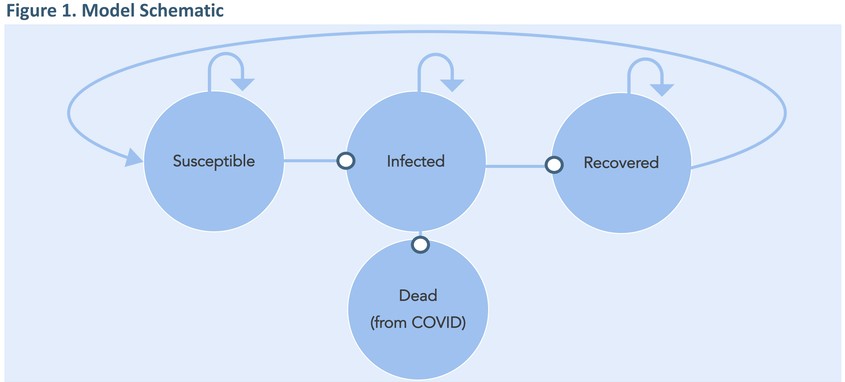
Objective

This analysis estimates the economic and clinical impact of increasing the utilization of DAAs to treat COVID-19, including a broader population of otherwise healthy individuals.

Methods

- A susceptible-infected-recovered-susceptible model was developed to estimate COVID-19-related outcomes based on DAA uptake (**Figure 1**).
- Cost-savings projected included reduced healthcare utilization amongst individuals and, importantly, potential savings attributable to reduced transmission.
- Cost inputs included treatment acquisition costs, adverse events, healthcare utilization, and productivity losses based on publicly available pricing guides and published literature.[4-10]
  - For productivity losses, we assumed 3 days of missed work for a non-hospitalized case, 5 days of missed work for an ER visit, and 10 days of missed work for a hospitalization, all costed at a US-average hourly wage of $32.58.[11] We did not include child or elder care expenses or other indirect costs.
- Clinical inputs were based on data from the Centers for Disease Control and Prevention and published literature.[12-15]
- One million hypothetical individuals were assessed in the model simulation with clinical and economic outcomes estimated for DAA adoption by risk level.

Figure 1. Model Schematic



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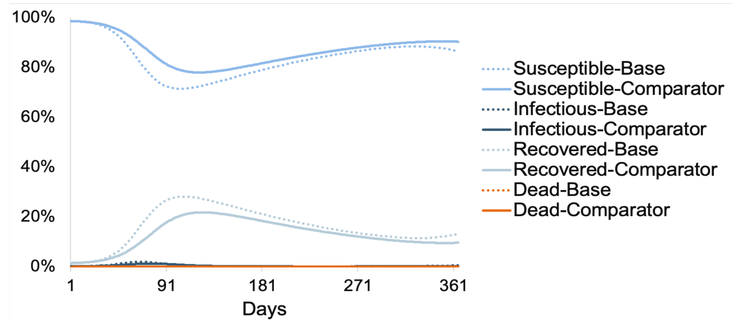
Results

Table 1. Clinical Outcomes per 1 Million Individuals

	Base Year	Comparator Year	Difference[a]
Total infections	402,430	311,891	90,539
Amongst high-risk individuals	80,486	62,378	18,108
Amongst standard risk individuals	321,944	249,513	72,430
Total deaths	151	107	45
Covid deaths	107	73	34
Office visits	97,360	77,004	20,355
ER visits	14,005	9,918	4,086
Hospitalizations	9,083	6,427	2,656
Long COVID cases	15,695	12,164	3,531

[a] Difference reflects reduction in burden in comparator year

Figure 2. Proportion of Individuals in Each Health State



Clinical Outcomes

- The model projects 402,430 new infections per 1 million individuals annually, leading to 9,083 hospitalizations and 107 deaths (**Table 1**).
- By increasing DAA use by 10% in the high-risk population and 20% in the standard-risk population, infections decreased to 311,891, with 2,656 fewer hospitalizations and 34 fewer deaths (**Table 1**).
- This projects to over 11,000 deaths averted for the full US population.
- Decreases in medical encounters were driven by reduction in transmission (77% of the decrease) and reduction in severity amongst those treated (23% of the decrease).
- Among deaths averted, 72% were attributable to the reduction in transmission.
- Rates of Long COVID decreased by 22%, including 706 cases in the high-risk population.

Table 2. Annual Costs Per 1 Million Individuals

	Base Year	Comparator Year
Adverse events cost	$73,130	$311,723
Healthcare utilization cost	$191,854,721	$137,285,667
Long COVID	$495,248,040	$383,827,769
Productivity losses	$486,361,741	$375,944,471
Total costs	**$1,173,537,632**	**$897,369,630**
Difference from base year	**–**	**-$276,168,002**

Figure 3. Total Costs by Scenario per 1 Million Individuals

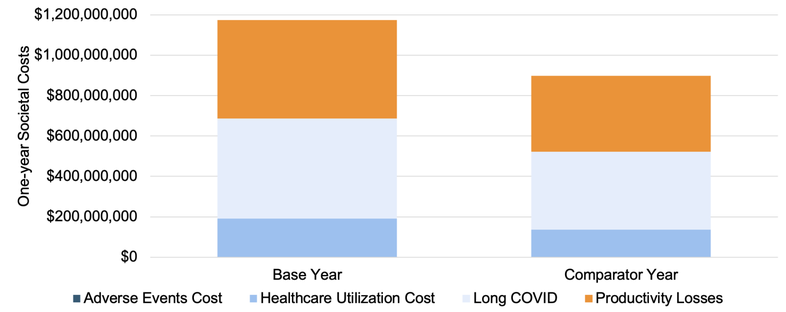
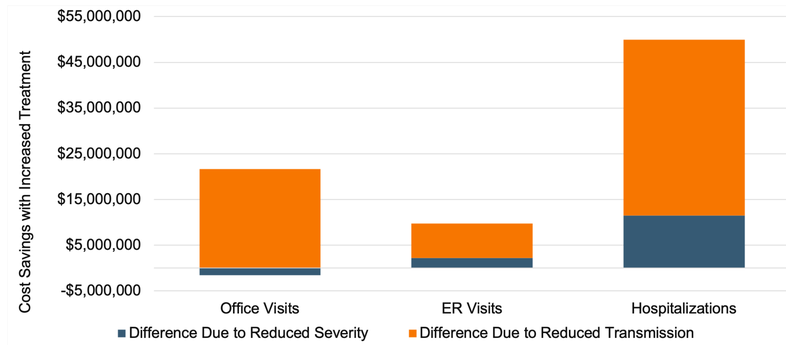


Figure 4. Healthcare Utilization Savings by Encounter Type



Economic Outcomes

- Total costs decrease by 23.5% with increased treatment (**Table 2, Figure 3**).
- The savings of $276 million in direct costs and productivity losses amongst one-million individuals would project to a savings of over $90 billion for the US population.
- Reductions in Long COVID-associated costs are 40% of the total cost savings associated with increased treatment.
- Within healthcare utilization costs, 84% of the decrease is due to reduced transmission with treatment (**Figure 4**).
- A reduction in productivity losses due to fewer infections results in $110 million in savings.

Conclusions

- **This study is among the first to model the potential population-level impact of DAAs in reducing infectivity and transmission, a factor currently under-emphasized in the literature.**
- **New DAAs under development with potentially improved safety profiles may expand the uptake of treatment and substantially reduce the clinical and economic burden of COVID-19.**

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