Alternative Pricing Models for Remdesivir and Other Potential Treatments for COVID-19

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ICER-COVID Model 1: Remdesivir Cost Recovery

Objective

The objective of this updated analysis was to provide estimates for the pricing of remdesivir in the treatment of COVID-19 that would represent a "cost recovery" approach. In this updated analysis, we present two cost recovery pricing estimates: 1) a price per treatment course that covers the minimal costs of production of the treatment; and 2) a price per treatment course that covers the cost of production plus the projected short-term spending by the manufacturer for clinical research directly related to the use of remdesivir for COVID-19.

Methods

The conceptual elements of the ICER model for a cost recovery pricing estimate include: 1) the marginal cost of producing the next course of remdesivir therapy; 2) research and development costs provided by the manufacturer; 3) and research and development costs provided by the federal government. The cost recovery pricing estimates do not include the remdesivir administration-related costs.

For remdesivir, we continue to use as one part of our estimate the analysis on the cost of producing the next course of therapy from an article by Hill et all in the Journal of Virus Eradication (2020). Their methods sought to determine the "minimum" costs of production by calculating the cost of active pharmaceutical ingredients, which is combined with costs of excipients, formulation, packaging and a small profit margin. Their analysis calculated a total cost of producing the "final finished product" of $9.32 US for a 10-day course of treatment. We rounded that amount up to $10 for a 10-day course. If a 5-day course of treatment becomes a recommended course of therapy, then the marginal cost would accordingly shrink to $5. In addition to this estimate we are now citing the pricing announced by three early generic producers of remdesivir in Bangladesh and India. Beximco, a Bangladeshi company, has announced a price range for patients treated in that country that translates into approximately $590-$710 for a 10-day treatment course. The company is planning to discount its product to the Bangladesh government while charging higher prices to private clinics in the country, so its announced price may represent a higher margin over cost of production in order to recoup the costs of donated or discounted doses. The two India-based companies, Hetero and Cipla, plan to launch their offerings for use in India at prices that would translate into costs between $390-$780 for a 10-day course of treatment. Given the $10 estimate from Hill et al, and the new information on early generic pricing in developing countries, we have chosen in this update to frame the cost recovery pricing for remdesivir as a range between $10 and a rough mid-point generic pricing figure of $600 per 10-day course.

Our updated report includes an estimate of federal investment in the earlier phases of research on remdesivir. For this purpose we used an analysis performed by Knowledge Ecology International that has been referenced by Public Citizen and Congressional leaders. Importantly, while this estimate includes figures from early research efforts on remdesivir, it does not include consideration of federal spending on trials such as ACTT-1 and other ongoing trials specific to COVID-19.

The extent to which drug maker expenditures on research and development should be considered as an empirical element in considerations of pricing for new treatments is disputed. As we noted in our initial report, we believe there are important reasons to assume that sunk research and development costs should not be used to help justify the price of new drugs. For remdesivir, this perspective is

strengthened by the fact that it was previously developed as part of a suite of agents for potential use in chronic Hepatitis C. Given that the manufacturer successfully launched other drugs for Hepatitis C, it seems reasonable that any sunk costs for research and development have already been recouped in the successful market experience of the manufacturer's other treatments in that area.

However, we believe that many policymakers will find it reasonable to include new research costs for studies directly related to evaluating the use of remdesivir for COVID-19 when calculating a cost recovery price benchmark. Therefore, in our updated analysis we have now added a pricing benchmark for cost recovery that includes projected spending by the sponsor (Gilead) for research directly related to understanding the risks and benefits of remdesivir for patients with COVID-19. We used public statements by Gilead for the purposes of estimating that they will spend approximately $1 billion in research on remdesivir in 2020 for this purpose.

In order to estimate the price that would recover these anticipated costs of research and development on remdesivir for COVID-19, it is necessary to choose the time course over which those costs must be recouped and a figure for the number of treatment courses that will be sold. There is great uncertainty about the time course and the scale of utilization of remdesivir, and market analysts have therefore projected a wide range of estimates for its uptake. Based on statements from Gilead, we have assumed at this stage that approximately 1 million treatment courses will be available and sold within the first year, and that the $1 billion cost should be recovered over this number of treated patients. Using these assumptions, the cost recovery pricing for remdesivir would need to include $1,000 for each course of treatment sold.

This second cost recovery pricing estimate is obviously very sensitive not only to the amount that Gilead actually spends on research and development, but on how many treatment courses are sold, and over what time course the costs are recouped. One possible policy approach to implementing a cost recovery pricing model would be to have a two-phase pricing model in which recovery of the costs for research and development is guaranteed within a short amount of time, resulting in a higher per-treatment price, followed by a reduction in price afterward to a level closer to the marginal cost of production.

Table 1 summarizes the key elements and findings of our updated cost recovery pricing model results. What remains unchanged is the need for policymakers and the public to debate whether these or other pricing paradigms are most appropriate if the goal is to create the right policy platform, for today and the future, to achieve rapid development and distribution of affordable treatments for a global pandemic.

Updated Results

Table 1. Cost Recovery Model Results

Minimal Marginal Cost*	Manufacturer R&D Costs	Public Investment in R&D Costs	Total Cost Recovery Pricing Options
$10-$600	Prior to COVID-19: *No data available*	Prior to COVID-19: $70 million	Option 1. Minimal marginal cost only: **$10-$600**
	Directly related to COVID-19: **$1 billion** projected by Gilead for 2020	Directly related to COVID-19: *No data available*	Option 2. Minimal marginal cost and 2020 projected manufacturer R&D costs: **$1,010-$1,600**[¥]

Per 10-day course of treatment

[¥] *Assuming all costs recovered over 1 million patients receiving a 10-day treatment course*

ICER-COVID Model 2: Remdesivir Cost-Effectiveness Analysis

Objective

The objective of this updated analysis was to estimate the cost-effectiveness and corresponding cost-effectiveness price benchmarks of remdesivir plus standard of care versus standard of care alone for hospitalized patients with COVID-19 and lung involvement.

Methods

We first highlight the major updates made to the structure and inputs of the model compared to the initial version that was the basis for the results released on May 1, 2020 (see full listing of model updates in the Appendix):

- Newly available peer-reviewed data from the Adaptive COVID-19 Treatment Trial (ACTT-1) were used, including an adjusted hazard ratio for mortality and an adjusted rate ratio for time to recovery.
- Average age at death was estimated based on US epidemiological evidence that was adjusted to the ACTT-1 population. The initial version assumed the average age at death was the same as the average age of the randomized population.
    - The estimated average age at death being higher than the average age of those randomized, alongside potential survival benefits of remdesivir, suggests a lower and differential average age for those who recovered. The estimated age for those who recover, by treatment arm, was used as the starting age for the Markov model.
- Annual health-related costs for those who recovered were updated to be consistent with evidence (the prior report included overestimates of these annual costs).
- Added scenario analyses assuming use of dexamethasone as part of standard care, incorporating emerging evidence on the impact of dexamethasone on mortality.
- Added equal value of life-years gained (evLYGs) as a model output given small differences from the quality-adjusted life years (QALYs).

We used a decision tree (Appendix Figure 1), populated by evidence from ACTT-1 and other sources, to estimate the costs, quality-adjusted life years (QALYs), and equal value of life-years gained (evLYGs) through hospital recovery or death. We estimated the lifetime costs and outcomes of remdesivir and standard of care by assigning the age-based average survival, healthcare costs, and utility for all those who recovered from the COVID-19 hospital event in a Markov Model (Appendix Figure 2). Consistent with prior ICER reviews, we generated evLYGs by assigning an average US general population utility of 0.851 to any observed life extensions within the Markov Model. We took the perspective of the healthcare sector in which third-party insurers pay for hospitalizations through bundled payments, but part of our update is to provide a scenario analysis in which there is a cost savings from a reduction in length of stay. Costs and outcomes were discounted at 3% per year. Health system capacity measures, healthcare personnel impacts, and impacts beyond that of the health system were not included in this analysis.

Model inputs are detailed in Appendix Table 1. Substantial clinical evidence uncertainty remains for remdesivir. In particular, the comparative remdesivir adjusted mortality benefit in ACTT-1 did not reach statistical significance, and the mortality benefit is a driver of the cost-effectiveness findings. To address

this uncertainty, we continued to include a scenario analysis assuming no mortality benefit for remdesivir. In addition, in this update we conducted a scenario analysis that assumed that dexamethasone was included within standard of care. The decision to present this scenario analysis was taken with input from clinical experts who suggested that dexamethasone will be viewed as standard of care immediately throughout the US, and that the relative benefits of remdesivir will now be judged to be most pertinent as an adjunct to dexamethasone treatment. The data on dexamethasone from the RECOVERY trial have not undergone peer review, and there are no data yet directly evaluating the outcomes of remdesivir plus dexamethasone versus dexamethasone alone. However, we judged that policy makers would benefit from a scenario analysis in which the relative mortality benefit of remdesivir and the remdesivir ACTT-1 population characteristics were applied on top of an underlying risk of mortality based on the relative reduction in mortality from the treatment arm of the RECOVERY trial.

Finally, in this update we provide new additional supporting scenarios with the following assumptions:

1. Per diem length of stay savings: hospital payments are not bundled into a hospital stay cost as is typical of most payers in the US, but rather, are monetized based on per diem estimates to allow for cost savings for reduced hospital days.
2. Use of remdesivir in the mild-moderate COVID-19 population: remdesivir outcomes modeled in the mild/moderate subpopulation of ACTT-1.

Updated Results

*Table 2. Cost-effectiveness price benchmarks**

Threshold	Base-case (assuming mortality benefit)	Scenario analysis assuming no mortality benefit	Scenario analysis assuming dexamethasone in standard of care
$50,000 per QALY and per evLYG	**$4,580 - $5,080**	**$310**	**$2,520 - $2,800**
$100,000 per QALY and per evLYG	$18,640 - $19,630	$620	$12,120 - $12,700
$150,000 per QALY and per evLYG	$32,700 - $34,180	$930	$21,730 - $22,590

evLYG=equal value of life years gained
QALY=quality-adjusted life year
**For all cost-effectiveness price benchmarks that include a range, the lower value was derived from QALYs and the higher value was derived from evLYGs.*

In this analysis, remdesivir extends life and improves quality of life versus standard of care. In public health emergencies, cost-effectiveness analysis thresholds are often scaled downward, and we feel the pricing estimate related to the threshold of $50,000 per incremental quality-adjusted life year (and equal value of a life-year gained) remains the most policy-relevant consideration. At that threshold, the updated ICER-COVID model suggests a base-case price of approximately $4,580 to $5,080 per treatment course. The no mortality benefit scenario analysis produces a lower cost-effectiveness price benchmark

of approximately $310 at the $50,000 per QALY threshold. Note that incremental QALYs are equivalent to incremental evLYGs for the no mortality benefit scenario and therefore, only one value was reported. To view some key outputs of the model, Appendix Table 2 reports the outcomes for remdesivir and standard of care, as well as incremental comparisons.

The range we now report as the updated cost-effectiveness price benchmark for a course of remdesivir at $50,000 per QALY and evLYG is similar to our May 1st estimate of $4,460. However, we highlight the following main revisions and how each revision impacted the base-case cost-effectiveness price benchmark estimate in terms of scope and scale:

- Updated population characteristics to that of ACTT-1
    - Small increase in cost-effectiveness price benchmark (due to lower age at hospitalization)
- Updated relative mortality and time to recovery benefits of remdesivir per the ACTT-1 adjusted estimates
    - Small decrease in cost-effectiveness price benchmark (due to adjusted relative benefits trending toward the null)
- Updated average age for those who died to be higher than that of those who recovered per epidemiologic evidence that was adjusted to the ACTT-1 population
    - Large decrease in cost-effectiveness price benchmark (due to higher age for remdesivir recovered population versus placebo recovered population)
- Updated annual health-related costs for those who recovered to be consistent with best-available evidence
    - Large increase in cost-effectiveness price benchmark (due to an overestimate of costs in prior report)
- Updated reporting to include price benchmarks related to evLYGs given small differences versus findings based on the QALY
    - A range of cost-effectiveness price benchmarks are now reported, with slightly higher price benchmarks corresponding to the evLYG outcome as compared to the QALY

As qualitatively described, the above revisions were evidence-based and mostly cancelled each other out. Further evidence-based revisions may increase or decrease the cost-effectiveness price benchmark.

The new scenario analysis that assumed that dexamethasone was included within standard of care (with its associated relative mortality benefits applied to the placebo arm within ACTT-1) yielded a remdesivir cost-effectiveness price benchmark of approximately $2,520 to $2,800. These price benchmarks are lower than the ACTT-1 base-case analysis because the same relative benefits of remdesivir were applied to a population that now has a lower risk of mortality due to dexamethasone's benefits, and therefore the overall lives and life years saved with remdesivir are lower. Further, the dexamethasone cost of approximately $15 for a ten-day course of treatment had no impact on the price benchmarks as it was applied to both the remdesivir and standard of care arms in this scenario analysis.

Our scenario analysis that evaluated the cost implications if hospital stays were paid exclusively through per diem amounts suggested a higher cost-effectiveness price benchmark of approximately $11,710 at a $50,000 per QALY threshold. We recognize that per diem payment is a rarity in the US healthcare

context but this scenario analysis may support further consideration of the hospital-specific benefits of more rapid time to improvement if that reduces pressure on ICU bed availability and/or overall hospital and staff functioning.

Our final scenario analysis evaluated use of remdesivir in the mild to moderate population, with outcomes taken from the newly available data from ACTT-1. As shown, use of remdesivir in this hospitalized population, with a lower standard of care risk of mortality of approximately 2%, produces a lower cost-effectiveness price benchmark of $2,360. This price benchmark is very similar to that for the scenario analysis in which remdesivir is used alongside dexamethasone for patients categorized as predominantly severe. See Appendix Table 3 for further details.

We will be continuing to monitor for new data on remdesivir and other emerging treatments for COVID-19, and we will perform further updates to our model as needed. In particular, there remains important uncertainty about the following elements that have a substantial impact on estimates of cost-effectiveness:

- The proportion of patients in the remdesivir and standard of care arms that achieve the highest hospitalization level of care (e.g. hospital ward without ICU or ventilation; ICU without ventilation; and ICU with ventilation).
    - The base-case model assumes no differences in the proportion of highest hospitalization level of care between remdesivir and standard of care.
- Payment levels for different insurers for COVID-19 or reasonable proxy hospital stays and how these reimbursed amounts vary by level of care as well as hospitalization stay duration.
    - The base-case model assumed variation in reimbursed amounts due to level of care but no variation in reimbursed amounts due to any potential differences in hospital length of stay.
- Differences in average costs or health decrements after recovering from COVID-19 as compared to the general US age- and gender-matched population.
    - The base-case model assumed no added costs or health decrements after recovering from COVID-19 as compared to the general US age- and gender-matched population.
- Comparative evidence on other relevant COVID-19 therapies alongside a rapidly changing standard of care.

APPENDIX

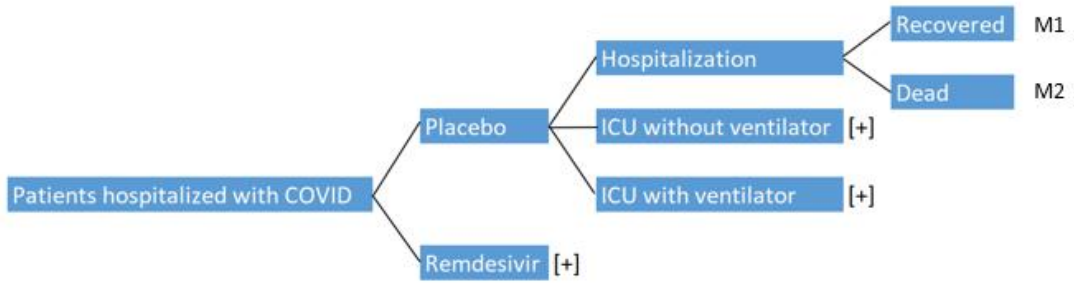
CEA Model Settings:

- Perspective: Health System
- Time Horizon: Lifetime
- Outcomes: Incremental costs, incremental QALYs, incremental evLYG
- Structure: short-term decision tree (models duration in highest hospital level of care and probability of death from highest hospital level of care) with long-term Markov model (health states of alive and dead with average age-based costs and consequences)
- Population: hospitalized patients with COVID-19 and lung involvement
- Discount rate of 3% for costs and outcomes

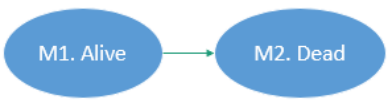
CEA Model Assumptions:

- For all those who recover in either the standard of care or remdesivir treatment arm, we assigned age- and gender-based probability of death, quality of life, and average healthcare costs
    - Future related and unrelated healthcare costs based on average age-adjusted healthcare costs
    - Future quality of life based on age-adjusted utility
        - To estimate evLYGs, a utility value of 0.851 was assigned to life extension (incremental life years comparing remdesivir versus standard of care) for each Markov model cycle.
    - Future death based on all-cause age- and sex-adjusted mortality
- Death prior to discharge occurred at the halfway point of the duration of the tree (at day 15 within the first 30 days)
- Treatment costs for remdesivir are in addition to a bundled hospital payment. We assumed no cost or disutility for potential adverse events separate from the cost and disutility of the admission.

Appendix Figure 1. Decision Tree Schematic



Appendix Figure 2. Markov Model



Appendix Table 1. CEA Model Inputs

Base-Case Model-Wide Inputs	Value	Source	Notes
Probability of hospitalization in general ward as highest healthcare setting	54%	ACTT-1	Table 1, ordinal scores 4 and 5 (127+421)/1017
Probability of ICU visit without ventilation as highest healthcare setting	19%	ACTT-1	Table 1, ordinal score 6 (197/1017)
Probability of ICU visit with ventilation as highest healthcare setting	27%	ACTT-1	Table 1, ordinal score 7 (272/1017)
Disutility of COVID symptoms	-0.19	Assumption & Smith & Roberts, 2002	For duration of time to recovery
Disutility of COVID hospitalization in general ward	-0.30	Assumption & Barbut et al., 2019	For duration of time to recovery; additive onto disutility of COVID symptoms
Disutility of COVID ICU visit without ventilation	-0.50	Barbut et al., 2019	For duration of time to recovery; additive onto disutility of COVID symptoms
Disutility of COVID ICU visit with ventilation	-0.60	Barbut et al., 2019	For duration of time to recovery; additive onto disutility of COVID symptoms
Healthcare resource cost when hospitalization in general ward was highest healthcare setting	$12,692	Rae et al., 2020	Median total cost for larger employer plans for Pneumonia inpatient stay; similar to other reported estimates (Bartsch et al. and Cohen et al.)
Healthcare resource cost when ICU visit with no ventilation was highest healthcare setting	$34,223	Rae et al., 2020	Median total cost for larger employer plans for Respiratory system diagnosis with ventilator support for less than 96 hours; similar to other reported estimates (Bartsch et al. and Cohen et al.)

Healthcare resource cost when ICU visit with ventilation was highest healthcare setting	$61,169	Rae et al., 2020	Average of the median total cost for larger employer plans for Respiratory system diagnosis with ventilator support for less than 96 hours and for 96 hours or more; similar to other reported estimates (Bartsch et al. and Cohen et al.)
Average age of population at hospital admission	58.9	ACTT-1	
Average age of population that died during hospitalization	71.61	US epidemiological evidence adjusted to ACTT-1 population	Adjustment for trial population was conducted to estimate average age at death given average age at hospitalization in ACTT-1 trial was less than average age of hospitalization in CDC estimates
Percent female	35.7%	ACTT-1	
Age-based utility	18-29 y/o: 0.922 30-39 y/o: 0.901 40-49 y/o: 0.871 50-59 y/o: 0.842 60-69 y/o: 0.823 70-79 y/o: 0.790 80+ y/o: 0.736	Sullivan & Ghushchyan, 2006	
Average general US population utility	0.851	Pickard AS et al., 2019	For generating evLYG outputs
Age-based future healthcare costs	0-18 y/o: $4,432 19-44 y/o: $5,741 45-64 y/o: $12,073 65-84 y/o: $20,071 85+ y/o: $38,900	Age-adjusted healthcare costs	Estimates from 2014 inflated to 2020 US dollars
Base-Case Remdesivir-Specific Inputs			
Adjusted rate ratio for time to recovery	1.31	ACTT-1	Applied to time to recovery from standard of care-specific inputs; standard-of-care time to recovery was divided by the adjusted rate ratio to generate remdesivir time to recovery inputs

Adjusted mortality hazard ratio	0.74	ACTT-1	Applied to mortality probabilities from standard of care-specific inputs
Probability of discontinuing remdesivir treatment	1.8%	ACTT-1	1- (531/541), converted to %
Percent of treatment regimen completed given discontinuation	50%	Gilead active arm study	
Base-Case Standard of Care-Specific Inputs			
Probability of recovering given hospitalization in general ward as highest healthcare setting	91%	ACTT-1	Recovery was assumed to be 1 minus a weighted average of the mortality probability reported in Table 2 for ordinal scores 4 and 5. Mortality probability: (60/259)*0.025 + (199/259)*0.109. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 11.9%, which was the overall standard of care mortality reported in the trial
Probability of recovering given ICU visit without ventilation as highest healthcare setting	85%	ACTT-1	Recovery was assumed to be 1 minus the mortality probability reported in Table 2 for ordinal score 6. Mortality probability: 0.147. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 11.9%, which was the overall standard of care mortality reported in the trial.

Probability of recovering given ICU visit with ventilation as highest healthcare setting	85%	ACTT-1	Recovery was assumed to be 1 – the mortality probability reported in Table 2 for ordinal score 7. Mortality probability: 0.141. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 11.9%, which was the overall standard of care mortality reported in the trial.
Time to recovery (days) given hospitalization in general ward as highest healthcare setting	7.68	ACTT-1	Weighted average of Table 2, ordinal scores 4 and 5 multiplied by an adjustment factor so the sum product of the three levels of care equated to 15, which was the overall time to recovery reported in the trial
Time to recovery (days) given ICU visit with no ventilation as highest healthcare setting	20.34	ACTT-1	Table 2, ordinal score 6 multiplied by an adjustment factor so the sum product of the three levels of care equated to 15, which was the overall time to recovery reported in the trial
Time to recovery (days) given ICU visit with ventilation as highest healthcare setting	25.89	ACTT-1	Table 2, ordinal score 7 multiplied by an adjustment factor so the sum product of the three levels of care equated to 15, which was the overall time to recovery reported in the trial
Inputs for Dexamethasone as a part of Standard of Care Scenario Analysis			

Standard of care mortality probability assuming dexamethasone was included within standard of care	8.9%	ACTT-1 and RECOVERY trial press release	Adjusted ACTT-1 placebo-specific mortality probabilities using hazard ratios in RECOVERY trial press release (0.8 for general ward hospitalization and ICU; 0.65 for ventilator)
Wholesale Acquisition Cost (WAC) for a 10-day course of once-daily dexamethasone (6mg tablet)	$14.87	Redbook	WAC pricing of $1.487 per 6mg tablet
Inputs for Hospitalizations Reimbursed per Day Scenario Analysis			
Cost per day given hospital general ward as highest level of care	$1,653	Rae et al., 2020 and ACTT-1	Cost per day was calculated by dividing total visit cost by standard of care time to recovery estimate for hospital general ward
Cost per day given ICU without ventilation as highest level of care	$1,683	Rae et al., 2020 and ACTT-1	Cost per day was calculated by dividing total visit cost by standard of care time to recovery estimate for ICU without ventilation
Cost per day given ventilation as highest level of care	$2,363	Rae et al., 2020 and ACTT-1	Cost per day was calculated by dividing total visit cost by standard of care time to recovery estimate for ventilation
Inputs for Mild to Moderate Hospitalization Subpopulation of ACTT-1 Scenario Analysis			
Probability of hospitalization in general ward as highest healthcare setting	99%	ACTT-1	Appendix table S2, sum of ordinal scores 1-5 at day 15 for mild/moderate disease stratum divided by those alive at day 15

Probability of ICU visit without ventilation as highest healthcare setting	1%	ACTT-1	Appendix table S2, sum of ordinal score 6 at day 15 for mild/moderate disease stratum divided by those alive at day 15
Probability of ICU visit with ventilation as highest healthcare setting	0%	ACTT-1	Appendix table S2, sum of ordinal score 7 at day 15 for mild/moderate disease stratum divided by those alive at day 15
Probability of recovering given hospitalization in general ward as highest healthcare setting	97%	ACTT-1	Recovery was assumed to be 1 minus the mortality probability reported in Table 2 for ordinal score 4. Mortality probability: 0.025. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 2.9%, which was the overall placebo mortality reported in the trial in the mild/moderate disease stratum.
Probability of recovering given ICU visit without ventilation as highest healthcare setting	84%	ACTT-1	Recovery was assumed to be 1 minus the mortality probability reported in Table 2 for ordinal score 6 Mortality probability: 0.147. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 2.9%, which was the overall placebo mortality reported in the trial in the mild/moderate disease stratum.

Probability of recovering given ICU visit with ventilation as highest healthcare setting	84%	ACTT-1	Recovery was assumed to be 1 minus the mortality probability reported in Table 2 for ordinal score 7. Mortality probability: 0.141. Mortality probability was then multiplied by an adjustment factor so the sum product of the mortality for the three levels of care equated to 2.9%, which was the overall placebo mortality reported in the trial in the mild/moderate disease stratum.
Time to recovery (days) given hospitalization in general ward as highest healthcare setting	4.83	ACTT-1	Table S2 of the appendix for the moderate population multiplied by an adjustment factor so the sum product of the three levels of care equated to 5, which was the overall time to recovery reported in table S2 of the appendix for the mild/moderate disease stratum
Time to recovery (days) given ICU visit with no ventilation as highest healthcare setting	21.23	ACTT-1	Table 2, ordinal score 6 multiplied by an adjustment factor so the sum product of the three levels of care equated to 5, which was the overall time to recovery reported in table S2 of the appendix for the mild/moderate disease stratum

Time to recovery (days) given ICU visit with ventilation as highest healthcare setting	27.02	ACTT-1	Table 2, ordinal score 7 multiplied by an adjustment factor so the sum product of the three levels of care equated to 5, which was the overall time to recovery reported in table S2 of the appendix for the mild/moderate disease stratum
Adjusted rate ratio for time to recovery	1.08	ACTT-1	Adjusted the recovery rate ratio reported in Table S2 of the appendix based on relative difference between adjusted and unadjusted recovery rate ratio for the overall population
Adjusted mortality hazard ratio	0.51	ACTT-1	Adjusted the mortality hazard ratio reported in Table S2 of the appendix based on relative difference between adjusted and unadjusted mortality hazard ratio for the overall population

Appendix Table 2: Base-case model outcomes and incremental comparisons, assuming a remdesivir full treatment course price of approximately $4,580

Treatment Arm	Treatment Costs¥	Other Healthcare Costs	Total Costs	Time to Recovery (days)	Discounted Life Years	Discounted QALYs	Discounted evLYG
Remdesivir plus Standard of Care*	$4,546	$314,613	$319,159	11.45	15.54	12.46	12.48
Standard of Care*	$0	$305,230	$305,230	15.00	15.18	12.18	12.19
Incremental (Remdesivir minus Standard of Care)	$4,546	$9,383	$13,929	-3.55	0.36	0.28	0.29

*Assumed same Standard of Care treatments and did not assign a unit cost as the incremental cost would be $0.

¥Treatment costs less than price benchmark due to discontinuation and rounding

Appendix Table 3: Cost-effectiveness price benchmarks for additional scenario analyses

Threshold	Hospitalization Reimbursed Per Day	Mild to Moderate Sub-Population
$50,000/QALY	$11,710	$2,360
$100,000/QALY	$25,770	$9,140
$150,000/QALY	$39,830	$15,920