Why We Should Be Willing to Pay for Hepatitis C Treatment

The launch of oral direct-acting antivirals (DAAs) to treat chronic hepatitis C virus (HCV) infection represents a significant shift in the HCV treatment paradigm. With DAAs, the sustained virologic response (SVR) (ie, efficacy of treatment) has increased to more than 90%, treatment duration has decreased to as few as 8 weeks, and these regimens have no major side effects. Coupled with the updates in HCV screening guidelines, use of new DAAs could make HCV a rare disease in the next 20 years in the United States.[1]

However, the high price of DAAs is a barrier, and has drawn criticism from patients and payers.[2–4] Challenged with a budget needed to treat all HCV patients, Medicaid has restricted these treatments in at least 30 US states to patients with advanced fibrosis stage.[5] With more than a million patients needing HCV treatment in the next 3 to 5 years in the United States, the high price of DAAs could impact the budget of private payers and government. On the other hand, several recent studies have shown that these drugs provide a good value for the money. Furthermore, the price of DAAs has decreased since their first availability. For example, the average discounts on sofosbuvir-based regimens in 2015 have been 46%.[6] As additional antiviral drugs become available in the near future, drug prices may decrease even further.

Here, we discuss the value of HCV treatment with oral DAAs considering new discounts, the importance of treating all HCV patients, and how HCV treatment costs and value compare with that of human immunodeficiency (HIV) treatment.

Value of Hepatitis C Virus Treatment

Recently published cost-effectiveness studies have shown that HCV regimens based on sofosbuvir, ledipasvir, and simeprevir are cost effective for most patients.[7–12] The incremental cost-effectiveness ratios (ICERs) of these regimens (when compared with the old standard of care) ranged from $10,000 to $284,000 per quality-adjusted life-year (QALY) depending on the patient's status with respect to treatment history, HCV genotype, and cirrhosis status. The average ICER for all HCV patients was $55,400 per QALY.[7] The ICERs of treatment with older therapies based on first-generation protease inhibitors, boceprevir and telaprevir, were between $17,000 and $103,000 per QALY, depending on disease stage.[13–17] The ICERs of peginterferon-ribavirin (in comparison with peginterferon) were between $26,000 and $64,000 per QALY. In general, the ICERs were higher in patients with early stages of liver fibrosis than in patients with advanced fibrosis. Collectively, these data show that throughout its history, compared with the previous standard, overall the "new" HCV treatment costs an additional approximately $50,000 to $100,000 for 1 additional QALY gained and the DAAs are no exception.

Hepatitis C Virus Treatment Now Is Cost Saving

With recent rebates on drug prices, sofosbuvir-based treatment in 2015, on average, costs 54% of the wholesale acquisition cost.[6] Applying these discounted drug prices to our previously published simulation model,[7] we evaluated the cost effectiveness of DAAs. We found that compared with treatment with telaprevir/boceprevir or peginterferon-based therapies, treatment with sofosbuvir–ledipasvir regimens is cost saving in the majority of patients (ie, these regimens increased QALYs and saved health care costs) (Figure 1). This effect was most prominent in patients with genotype 1 infection. Treatment was not cost saving, although it was cost effective, in patients with other genotypes.

Decreased Cost per Sustained Virologic Response

Although the cost of antiviral treatment increased with the availability of new therapies, the cost per SVR has decreased. As shown in Figure 2, the cost of treating HCV genotype 1 with peginterferon–ribavirin, first-generation protease inhibitors, and sofosbuvir–ledipasvir (at wholesale acquisition cost) increased from $43,000 to $103,000 per patient. However, the corresponding costs per SVR decreased from $213,000 to $108,000. After applying the recent discounts (46%), the cost of treatment decreased to $56,000, which is less expensive than boceprevir- and telaprevir-based therapies, and the cost per SVR decreased to $58,000.

Health Economics of Hepatitis C Virus Versus Human Immunodeficiency Virus Treatment

HCV has superseded HIV as a cause of death in the United States since 2007.[18] Therefore, to put the health economics of HCV into perspective, we can compare the cost of HCV treatment with DAAs with the

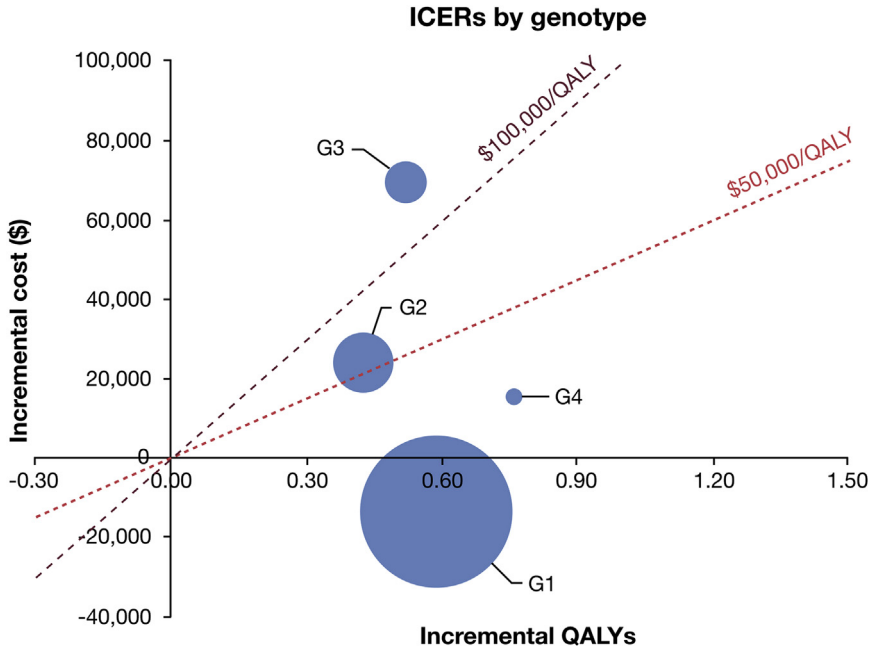

Figure 1. Incremental cost and effectiveness of new antiviral regimens in comparison with old standard of care by HCV genotype. The size of each *bubble* represents the relative population size needing treatment. The center of the bubble represents the incremental costs and QALYs of sofosbuvir/ledipasvir-based therapies in comparison with the old standard of care. *Bubbles* below the *red line* are cost effective at that threshold, and *bubbles* below the *green line* are cost-saving strategies. For instance, treatment of genotype 1 patients with sofosbuvir–ledipasvir in comparison with telaprevir/boceprevir will increase QALYs and decease costs (ie, cost-saving strategy). Treatment of genotype 4 patients will increase both QALYs and costs, but is still cost effective at a $100,000 willingness-to-pay threshold. The weighted average of the results across all genotypes is cost saving.

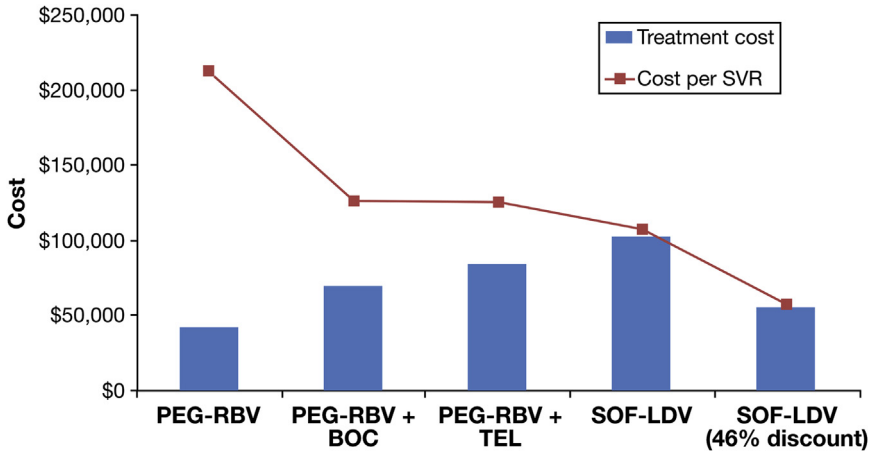

Figure 2. Cost and cost per SVR of different antiviral regimens to treat patients with hepatitis C virus genotype 1. The cost of treatment increased from peginterferon–ribavirin (PEG-RBV) to sofosbuvir–ledipasvir (SOF-LDV) in genotype 1 patients, however, the corresponding costs per SVR decreased at the same time. Furthermore, at 46% discounts, both costs and cost per SVR of SOF–LDV were lower than boceprevir (BOC)- and telaprevir (TEL)-based therapies, the old standard of care.

cost of treating HIV. The discounted lifetime cost of treating 1 person with HIV in the United States is $315,000 in 2014 US dollars.[19] The corresponding cost of curing HCV with oral DAAs is $58,000–which is only 18% of the total HIV treatment cost. HIV antiretroviral treatment is cost effective in the United States,[20] HCV treatment is cost saving.

The total federal budget requested for HIV and acquired immune deficiency syndrome in 2015 was $24.2 billion, of which $17.5 billion was allocated to HIV treatment and care.[21] Ryan White's Acquired Immune Deficiency Syndrome Drug Assistance Program, which provides access to HIV-related medications to people with HIV, was funded at $900 million. The federal spending on HCV treatment is unknown. However, using a simulation model, we predicted that the maximum 5-year budget needed to treat all patients (by private as well as government payers) who are candidates for HCV treatment would be $37 billion (ie, $7.4 billion per year).[7] Of note, unlike HIV, HCV treatment offers a cure; therefore, annual spending on HCV treatment would decrease sharply in subsequent years.

Why We Should Be Willing to Pay for Hepatitis C Virus Treatment

The cost of HCV treatment with the available oral DAAs has decreased substantially since their first availability in 2014. Furthermore, we anticipate more discounts with increased competition from other manufacturers in the near future. The overall budget needed to treat HCV is not huge and is reasonable when compared with that of HIV. Therefore, HCV treatment should be not be restricted only to

patients in advanced fibrosis stages. We have an opportunity to eliminate hepatitis C by taking appropriate and timely steps. We as a society should be willing to pay for the current HCV therapies by providing additional resources and giving the attention to hepatitis C that it deserves.

JAGPREET CHHATWAL
Institute for Technology Assessment
Massachusetts General Hospital
Harvard Medical School
Boston, Massachusetts

QIUSHI CHEN
H. Milton Stewart School of Industrial and Systems Engineering
Georgia Institute of Technology
Atlanta, Georgia

FASIHA KANWAL
Houston Veterans Affairs Health Services Research and Development Center of Excellence
Michael E. DeBakey Veterans Affairs Medical Center
Houston, Texas

Department of Medicine
Gastroenterology and Hepatology
Baylor College of Medicine
Houston, Texas

References

1. Kabiri M, Jazwinski AB, Roberts MS, et al. The changing burden of hepatitis C in the United States: model-based predictions. Ann Intern Med 2014;161:170–180.
2. Sussman NL, Remien CH, Kanwal F. The end of hepatitis C. Clin Gastroenterol Hepatol 2014;12:533–536.
3. Hoofnagle JH, Sherker AH. Therapy for hepatitis C—the costs of success. N Engl J Med 2014;370:1552–1553.
4. Knox R. $1,000 pill for hepatitis C spurs debate over drug prices. NPR. December 30, 2014. Available: http://www.npr.org/blogs/health/2013/12/30/256885858/-1-000-pill-for-hepatitis-c-spurs-debate-over-drug-prices. Accessed: March 21, 2014.
5. Japsen B. As pricey hepatitis pill Harvoni joins Sovaldi, states erect Medicaid hurdles. Forbes. Available: http://www.forbes.com/sites/brucejapsen/2014/10/10/as-hepatitis-pill-harvoni-joins-sovaldi-states-erect-medicaid-hurdles/. Accessed: February 4, 2015.
6. Silverman E. What the 'shocking' Gilead discounts on its Hepatitis C drugs will mean. The Wall Street Journal. Available: http://blogs.wsj.com/pharmalot/2015/02/04/what-the-shocking-gilead-discounts-on-its-hepatitis-c-drugs-will-mean/. Accessed: February 4, 2015.
7. Chhatwal J, Kanwal F, Roberts MS, et al. Cost-effectiveness and budget impact of hepatitis C virus treatment with sofosbuvir and ledipasvir in the United States. Ann Intern Med 2015;162:397–406.
8. Linas BP, Barter DM, Morgan JR, et al. The cost-effectiveness of sofosbuvir-based regimens for treatment of hepatitis C virus genotype 2 or 3 infection. Ann Intern Med 2015;162:619–629.
9. Najafzadeh M, Andersson K, Shrank WH, et al. Cost-effectiveness of novel regimens for the treatment of hepatitis C virus. Ann Intern Med 2015;162:407–419.
10. Rein DB, Wittenborn JS, Smith BD, et al. The cost-effectiveness, health benefits, and financial costs of new antiviral treatments for hepatitis C virus. Clin Infect Dis 2015;61:157–168.
11. Kuwabara H, Westerhout K, Treur M, et al. Cost-effectiveness analysis of simeprevir in combination with peginterferon and ribavirin for treatment-naive chronic hepatitis C genotype 1 patients in Japan. J Med Econ 2015;18:502–511.
12. Younossi ZM, Park H, Saab S, et al. Cost-effectiveness of all-oral ledipasvir/sofosbuvir regimens in patients with chronic hepatitis C virus genotype 1 infection. Aliment Pharmacol Ther 2015;41:544–563.
13. Brogan AJ, Talbird SE, Thompson JR, et al. Cost-effectiveness of Telaprevir combination therapy for chronic hepatitis C. PLoS One 2014;9:e90295.
14. Chhatwal J, Ferrante SA, Brass C, et al. Cost-effectiveness of boceprevir in patients previously treated for chronic hepatitis C genotype 1 infection in the United States. Value Health 2013;16:973–986.
15. Ferrante SA, Chhatwal J, Brass CA, et al. Boceprevir for previously untreated patients with chronic hepatitis C genotype 1 infection: a US-based cost-effectiveness modeling study. BMC Infect Dis 2013;13:190.
16. Liu S, Cipriano LE, Holodniy M, et al. New protease inhibitors for the treatment of chronic hepatitis C: a cost-effectiveness analysis. Ann Intern Med 2012;156:279–290.
17. Chan K, Lai MN, Groessl EJ, et al. Cost effectiveness of direct-acting antiviral therapy for treatment-naive patients with chronic HCV genotype 1 infection in the veterans health administration. Clin Gastroenterol Hepatol 2013;11:1503–1510.
18. Ly KN, Xing J, Klevens RM, et al. The increasing burden of mortality from viral hepatitis in the United States between 1999 and 2007. Ann Intern Med 2012;156:271–278.
19. Schackman BR, Gebo KA, Walensky RP, et al. The lifetime cost of current human immunodeficiency virus care in the United States. Med Care 2006;44:990–997.
20. Walensky RP, Freedberg KA, Weinstein MC, et al. Cost-effectiveness of HIV testing and treatment in the United States. Clin Infect Dis 2007;45-(Suppl 4):S248–S254.
21. Kaiser Family Foundation. US federal funding for HIV/AIDS: the President's FY 2015 budget request. Available: http://kff.org/global-health-policy/fact-sheet/u-s-federal-funding-for-hivaids-the-presidents-fy-2015-budget-request/. Accessed: April 8, 2015.

Conflicts of interest
This author discloses the following: Jagpreet Chhatwal has received consulting fees from Merck, Gilead, and Complete Health Economics Outcomes Research Solutions. The remaining authors disclose no conflicts.

Most current article

http://dx.doi.org/10.1016/j.cgh.2015.06.005