Cost and Access to Direct-Acting Antiviral Agents

Background

Since 2014, the United States Food and Drug Administration (FDA) has approved a new wave of direct-acting antiviral (DAA) oral medications that has revolutionized the landscape for hepatitis C virus (HCV) treatment. Compared with older HCV treatments, DAA therapy is more effective, easier to tolerate, and significantly shorter in duration. In addition, the newer DAA-based therapies are highly effective in traditionally more difficult-to-treat patients, including those with cirrhosis, HIV coinfection, renal failure, or prior HCV treatment experience. Enthusiasm for DAA therapies, however, has been tempered by two major concerns: (1) the high price of these medications and (2) challenges patients and clinicians face with respect to drug access. For medical providers, the process of obtaining insurance approval for new HCV treatment regimens can be daunting, complicated, and time-consuming. In addition, even when insurance approval for the medication occurs, it may occur only after a substantial delay, potentially resulting in loss to follow-up. The purpose of this core concept is to describe some of the financial barriers to obtaining medication, review some cost-effectiveness data on these therapies, and provide practical guidance on how medical providers can navigate the system to increase access to HCV treatment for their patients.
Price of Direct-Acting Antiviral Agents

List "Sticker" Price

The price of the drug typically discussed in the public arena is the wholesale acquisition cost, which is the published list or "sticker" price of the medication set by the pharmaceutical company. The DAA medications are among of the most expensive oral medications in history, with wholesale acquisition prices ranging from $417 (glecaprevir-pibrentasvir) to $1,125 per day (ledipasvir-sofosbuvir) (Figure 1). The wholesale acquisition costs are substantially higher than the estimated production costs for the medications (Figure 2).[1] For example, the wholesale acquisition cost of a 12-week course of sofosbuvir is $84,000 and the estimated production cost is $68 to $136. The pharmaceutical companies justify the significant discrepancy in wholesale acquisition cost and production cost based on a need to recoup large expenses incurred during the research and development process for the medication. The ultimate "price for cure" of a recommended HCV treatment course depends predominantly on the liver disease severity and the cost of the regimen used (Figure 3). For example, the cost of recommended initial therapy for a treatment-naïve patient with genotype 1a ranges from $26,500 to $94,500.

Actual Medication Cost

The actual cost paid for the medications may be significantly lower than the wholesale acquisition cost, due to a multitude of factors, including contracts, rebates, and discounts negotiated between payers and pharmaceutical companies.[2] Although the wholesale acquisition cost is general public knowledge, information on the actual cost paid is not available to the public and often vastly different than the public wholesale acquisition cost. Negotiations for pricing can vary considerably and depend in large part on the nature of the payer.[2]

Pharmacy Benefit Management

In many settings, negotiations for medication payments are conducted on behalf of insurance plans by pharmacy benefit management, a third-party generally for-profit intermediary in the pharmacy supply chain, which can greatly influence the actual drug cost and potential reimbursement rates. When insurance companies are allied with pharmacy benefit management, the agreements may facilitate medication access by lowering drug cost but often do so in exchange for exclusivity (restrictions that dictate which medication can be prescribed) and thereby may reduce choice for the medical provider and patient. These negotiations of drug pricing between pharmaceutical companies and payers or pharmacy benefit management are for all intents and purposes confidential business dealings and can obscure the price transparency that is otherwise part of a truly free market.[3] Overall, the use of pharmacy benefit management can complicate efforts to get DAA medications to patients.

Restricted Access of Costly HCV DAA Medications

Even with such negotiated discounts, the cost of these drugs can prohibit widespread access. One study that examined the published discount prices of sofosbuvir and ledipasvir-sofosbuvir in countries where such data were available suggested that paying for widespread treatment in national health systems would still consume large proportions of their entire pharmaceutical budget.[4] The high cost of these DAAs has garnered considerable public scrutiny and outcry from the press and medical community.[5] These conflicts have resulted in a large number of class-action lawsuits. Only recently, with the FDA approval of the much less expensive glecaprevir-pibrentasvir in August 2017, a pangenotypic and highly effective regimen, has the cost of DAA therapy become more widely accessible through insurance and federally-funded programs.
Cost-Effectiveness of Direct-Acting Antiviral Agents

Definitions Related to Cost-Effectiveness Analysis

A cost-effectiveness analysis is a formal method to compare the costs and clinical outcomes associated with one intervention with another “standard” comparator and can be used to help set funding priorities. The unit used for this comparison is the incremental cost-effectiveness ratio (ICER), which is a statistic used to summarize the effectiveness of a health care intervention; the ICER is a ratio defined as the difference between the cost of two possible interventions divided by the difference in health effects of the two interventions (Figure 4). The most common application of ICER related to hepatitis C therapy is a cost-effectiveness analysis and the ICER is typically measured as cost per quality-adjusted life years (QALY) gained between two strategies. For example, a typical hepatitis C treatment ICER uses the costs of different therapies as the intervention comparison (cost of new therapy minus the old therapy) divided by the QALY comparison (QALY with new therapy minus QALY of old therapy) (Figure 5). The ICER is then determined as the cost in dollars per quality of life year gained. Once the ICER is calculated, it is examined against a benchmark, generally $50,000 to $100,000 per QALY gained, which is considered in the United States to be our society’s “willingness to pay” threshold, although this value is clearly debatable.[6]

Issues to Consider with Cost-Effectiveness Studies

There are some caveats to consider in cost-effectiveness analyses. First, these statistical models are based on multiple variables related to treatment strategies and the natural history of HCV disease (largely based on prior literature) that should be noted carefully before interpreting results. Second, the cost-effectiveness analysis assumes the main objective is to maximize net health benefits for a target population under constrained resources, a primary goal that may not be shared by clinicians who are more focused on the welfare of the individual patients they serve. Third, these analyses comprise only one of many criteria, including political, societal, and ethical priorities that need consideration when making decisions related to resource allocation. This last consideration is important when considering HCV therapy with DAAs. Most published cost-effectiveness analysis studies have reported that new treatments for hepatitis C appear to be cost-effective compared with older comparators, but note that the benefit to society (and payers) would not occur until at least 10 years after the initial treatment.[7] Although it is clear that while HCV DAAs may be cost-effective, the projected cost of widespread medication coverage of all persons living with HCV infection in the United States may not be affordable or feasible.[8,9]

Cost-Effectiveness Studies with DAAs

Multiple cost-effectiveness studies have been conducted to analyze the cost-effectiveness of DAAs for the treatment of chronic HCV.[10,11,12,13,14] The following summary highlights several key cost-effectiveness studies. Notably, most cost-effectiveness studies have not accounted for the potential treatment benefits accrued with reduction of non-liver-related morbidity or the societal benefit of prevention of transmission of HCV infection, all of which may confer significant downstream cost savings. In addition, these cost-effectiveness analyses have not included analyses with glecaprevir-pibrentasvir, the lowest cost DAA therapy.

• **Ledipasvir-Sofosbuvir**: Several cost-effectiveness analysis studies have examined the cost-effectiveness of ledipasvir-sofosbuvir in treating HCV genotype 1 infection and most demonstrated this combination was cost-effective in selected groups compared with older standard of care (some version of interferon-based therapy), with most ICERS in the “willing to pay” range of less than $100,000 per QALY gained.[9,15,16,17,18] In one of these studies, treatment-experienced patients with genotype 1 infection and cirrhosis had a higher ICER than those without cirrhosis, mainly due to the greater cost of the ledipasvir-sofosbuvir treatment course for treatment-experienced patients with cirrhosis (Figure 6).[9] This
analysis used a 24-week treatment course for treatment-experienced patients with cirrhosis, but current guidelines for genotype 1a and 1b patients do not extend ledipasvir-sofosbuvir treatment to longer than 12 weeks, even in treatment-experienced patients with cirrhosis.\[9,19,20\]

- **Sofosbuvir-Based Therapy for Genotypes 2 and 3**: Two studies examined the cost-effectiveness of sofosbuvir-based therapy.\[15,21\] In one model, sofosbuvir-based regimens for HCV genotype 2 or 3 were considered cost-effective for treatment-experienced patients and those with cirrhosis, but not for treatment-naïve patients without cirrhosis.\[21\] In the second study, investigators generated models for multiple sofosbuvir-based regimens and most were considered cost-effective. Both of these studies used models based on the early and limited availability of DAA medications.\[15,21\]

- **DAA Therapy for Genotype 1**: In a review of cost-effectiveness studies conducted from January 1, 2011 to September 8, 2015, investigators analyzed 24 cost-effective studies on first- and second-generation DAAs for the treatment of chronic HCV genotype 1.\[11\] For the studies conducted in the United States, the second-generation DAAs were cost-effective (using a threshold of $100,000-per-QALY) if priced less than $260,300 and cost-saving if less than $79,000.\[11\] At an estimated cost of $60,000 for treatment of HCV genotype 1, a total of 71% of the analyses determined the second-generation DAAs were cost-saving.\[11\]

- **DAA Therapy for Genotypes 2-6**: In a review of cost-effectiveness studies for chronic HCV genotypes 2-6 that were conducted from January 1, 2011 to August 28, 2016, investigators analyzed the cost-effectiveness of 10 studies and 92 ICERs on DAA therapy.\[10\] Using a threshold of $100,000-per-QALY, the analysis determined that the median threshold price below which treatment becomes cost-effective was $144,427 for genotype 2, $146,700 for genotype 3, and $225,000 for genotype 4.\[10\] The regimens were considered cost-saving, with a median threshold price of less than $17,344 for genotype 2, $17,924 for genotype 3, and $25,426 for genotype 4.\[10\]
Process to Acquire HCV Treatment Medications

Insurance and Medicaid Approval

Because of the very high cost of new HCV regimens, many insurance companies and Medicaid programs require a prior authorization in order for the patient to receive the medications.[22,23] To date, insurance carriers do not have a uniform policy as to who qualifies for hepatitis C treatment, which adds complexity and challenges for patients and providers seeking DAA coverage. In addition, each state has its own Medicaid policies related to HCV therapy, and there is no uniform national policy as to who qualifies for the treatment under Medicaid. Many payers have adopted guidelines that involve rationing treatment to patients with advanced liver fibrosis (Metavir F3 or F4 fibrosis) or those patients deemed to have higher medical priority based on a variety of clinical features. Clinicians who care for Medicaid patients with hepatitis C should attempt to find state-specific policies on prior authorization for hepatitis C treatment by contacting their state Medicaid board. The National Viral Hepatitis Roundtable and Harvard Center for Health Law and Policy Innovation provided a national summary of state Medicaid policies on HCV drug access in November 2016.[24] In addition, this same organization has produced an online, state-by-state assessment of DAA access through Medicaid programs (see Hepatitis C: State of Medicaid Access).

Requirements to Acquire DAAs for Patients

Insurance companies and Medicaid programs often have multiple requirements that must be met before DAAs are authorized. These restrictive criteria may dictate who can prescribe DAAs and what clinical documentation and laboratory testing is necessary. They may stipulate the type of methods and criteria used for fibrosis staging. After the prescription for medication has been submitted, the patient should be counseled that it may take months before they receive a decision from their insurance company. The following list outlines some of the potential requirements that providers may encounter and note these vary by insurance and state:

- **Provider Experience**: Some policies stipulate that only certain medical providers that have adequate expertise in treating hepatic C can prescribe DAAs. Typically, hepatologists, gastroenterologists, and infectious diseases specialists have been granted permission to prescribe DAAs without any further requirements. General medical providers may need documentation of consultation support by experts, such as through the Extension for Community Health Outcome (ECHO) programs.[25,26]

- **Fibrosis Staging**: In most circumstances, insurers will require proof of fibrosis staging. Degree of fibrosis can be established by (1) liver biopsy OR (2) a combination of noninvasive measures, including AST-to-platelet ratio index (APRI), FibroTest (FibroSURE), and transient elastography.

- **Baseline Laboratory Studies**: Most insurance plans will require a thorough evaluation with laboratory studies prior to receiving approval for medications to treat HCV. Typical required baseline laboratory studies are listed below. In addition, except for the HCV genotype, a window of time may be required for these laboratory studies to be accepted as pretreatment studies.
  - HCV Genotype
  - HCV RNA
  - Complete blood count (CBC)
  - Serum creatinine and calculated glomerular filtration rate
  - Prothrombin Time (PT)/International Normalized Ratio (INR)
  - Hepatic function panel: albumin, total and direct bilirubin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase

- **Clinic Note Documentation**: Some or all of the following patient-specific information may be required in order to qualify for treatment coverage:
  - Alcohol sobriety for at least 6 months
CAGE or AUDIT-C alcohol use survey if the patient is not 100% abstinent to alcohol
No injection drug use for at least 6 months
Drug or alcohol screening tests
Pregnancy status if female of childbearing age
Evaluation of psychosocial readiness for treatment
Justification of choice of regimen and duration of treatment
Documentation of hepatitis A and B status

Medicaid Guidance

Effective November 5, 2015, the Centers for Medicare and Medicaid Services (CMS) released guidance documents (Assuring Medicaid Beneficiaries Access to Hepatitis C Drugs) for states with regard to access restrictions on DAA treatments for hepatitis C in state Medicaid programs. In this guidance, they note that although states have the discretion to establish limitations on coverage—for example, through preferred drug lists and use of prior authorization—these practices must ensure access to clinically appropriate treatment. Further, this CMS document states that limiting access to treatment to individuals with a fibrosis score of F3 or F4, requiring a period of abstinence from drug and alcohol use, or significantly limiting the types of providers able to prescribe hepatitis C drugs are examples of unreasonable restrictions on access to treatment. It remains to be seen whether this CMS guidance document will change Medicaid restrictions. On this web site, CMS also has links to template letters to pharmaceutical companies that manufacture DAA medications currently in use in the United States.

Insurance Denials

The insurance companies may block treatment with an outright denial, or they may deny a specific medication selection or duration of therapy. If the insurance company denies a medication for the patient, the medical provider should resubmit the application for the medication, with a specific appeal letter qualifying the request as a reapplication. Given the complexity of this process, assistance from a pharmacist or pharmacy technician, or someone experienced with the process, can prove crucial to ensure a streamlined process for the patient medication approval. In general, if a patient’s medication request is rejected twice they can apply for a patient assistance program with the pharmaceutical manufacturer, if that manufacturer has an active patient assistance program and the patient’s financial circumstances meet the program’s requirements.

Pharmaceutical Patient Assistance Programs

If an insurance company denies a patient’s HCV medication prescription twice, providers should consider contacting the pharmaceutical company's Patient Assistance Program. Unfortunately, not all medications have pharmaceutical company Patient Assistance Programs. Of note, the Gilead Support Path Program for ledipasvir-sofosbuvir and sofosbuvir now provides free medication only for eligible uninsured patients. In general, for most of the other patient assistance programs, patients are considered for patient assistance only if their application has been rejected by their insurance company twice—the application resubmitted to their insurance company and rejected a second time (must be within 60 days of the first rejection)—and their income is less than $100,000 per year. Patients should be counseled that the pharmaceutical company assistance program will likely require tax information, social security benefits, and other documents that reflect a patient’s income. The following is a list of active hepatitis C treatment pharmaceutical-sponsored patient assistance programs for patients living in the United States.
Patient Advocacy Groups

Several groups have emerged that can act as advocates for patients struggling to deal with the diagnosis, symptoms and complications from Hepatitis C as well as act as advocates and resources for patients struggling through the insurance approval and drug assistance process. Such groups include:

- **Patient Advocate Foundation:** The Patient Advocate Foundation's [Hepatitis C CareLine](#) is a hotline (800-532-5274) for both patients and medical providers: this service is a nonprofit organization that provides assistance, including case management services, to persons living with chronic HCV infection. The Hepatitis C CareLine has case managers that will assist patients in efforts to try and access new medications to treat hepatitis C.

- **HCV Advocate:** The [HCV Advocate](#) is a nonprofit organization founded in 1997 geared to providing education, support, and services to person living with HCV infection (with or without HIV coinfection, and to medical providers. The website includes educational material about HCV appropriate for patients, information about HCV and disability services, information about the Hepatitis C Support Project (HCSP), updates on clinical trials for HCV treatments, and current news updates on HCV news and HCV treatment.
Summary Points

- New DAAs have been highly effective in treating chronic HCV infection, but the high cost of these medications has served as a major barrier to more widespread treatment access.
- The wholesale acquisition cost for the newer DAAs ranges from $417 to $1,125 per day. The actual price paid for the medication may be significantly lower because of contracts, rebates, and discounts.
- Most new regimens for hepatitis C treatment have been shown to be cost-effective, but given the large numbers of persons infected with hepatitis C in the United States, universal treatment is not feasible at the current prices of these medications.
- The process of acquiring prior authorization approval for DAAs for patients with hepatitis C can be confusing and time-consuming, particularly with respect to staying up to date with the restrictions and requirements of various insurance plans.
- Many insurance and state Medicaid programs are only approving DAAs for hepatitis C treatment for patients with F3 or F4 fibrosis.
Citations


7. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Overview of cost, reimbursement, and cost-effectiveness considerations for hepatitis C treatment regimens. [AASLD-IDSA Hepatitis C Guidance]


19. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Retreatment of persons in whom prior therapy has failed: peginterferon/ribavirin-experienced, genotype 1a patients with compensated cirrhosis. [AASLD-IDSA Hepatitis C Guidance] -

20. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. Retreatment of persons in whom prior therapy has failed: peginterferon/ribavirin-experienced, genotype 1b with compensated cirrhosis. [AASLD-IDSA Hepatitis C Guidance] -


24. National Viral Hepatitis Roundtable (NVHR) and the Center for Health Law and Policy


References


# Figures

**Figure 1 Wholesale Acquisition Cost of Direct-Acting Antiviral Agents**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Trade Name</th>
<th>Manufacturer</th>
<th>WAC for 1 Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daclatasvir</td>
<td>Daklinza</td>
<td>Bristol-Myers Squibb</td>
<td>$750</td>
</tr>
<tr>
<td>Elbasvir-Grazoprevir</td>
<td>Zepatier</td>
<td>Merck &amp; Co., Inc.</td>
<td>$650</td>
</tr>
<tr>
<td>Ledipasvir-Sofosbuvir</td>
<td>Harvoni</td>
<td>Gilead Sciences</td>
<td>$1125</td>
</tr>
<tr>
<td>Glecaprevir-Pibrentasvir</td>
<td>Mavyret</td>
<td>AbbVie</td>
<td>$417</td>
</tr>
<tr>
<td>Ombitasvir-Paritaprevir-Ritonavir</td>
<td>Technivie</td>
<td>AbbVie</td>
<td>$912</td>
</tr>
<tr>
<td>Ombitasvir-Paritaprevir-Ritonavir and Dasabuvir</td>
<td>Viekira XR</td>
<td>AbbVie</td>
<td>$992</td>
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<tr>
<td>Simeprevir</td>
<td>Olysio</td>
<td>Janssen</td>
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<tr>
<td>Sofosbuvir</td>
<td>Sovaldi</td>
<td>Gilead Sciences</td>
<td>$1000</td>
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<tr>
<td>Sofosbuvir-Velpatasvir</td>
<td>Epclusa</td>
<td>Gilead Sciences</td>
<td>$890</td>
</tr>
<tr>
<td>Sofosbuvir-Velpatasvir-Voxilaprevir</td>
<td>Vosevi</td>
<td>Gilead Sciences</td>
<td>$890</td>
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</table>
Figure 2 Wholesale Acquisition Cost versus Estimated Production Cost for DAAs and 12-Week Treatment Course

### Estimated Wholesale Acquisition Cost (WAC)

#### Recommended Regimens for GT1a HCV, without Cirrhosis

<table>
<thead>
<tr>
<th>Regimens and Duration of Therapy</th>
<th>Cost of Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Elbasvir-Grazoprevir x 12 weeks</td>
<td>$54,600</td>
</tr>
<tr>
<td>Glecaprevir-Pibrentasvir x 8 weeks</td>
<td>$26,400</td>
</tr>
<tr>
<td>^Ledipasvir-Sofosbuvir x 8 weeks</td>
<td>$63,000</td>
</tr>
<tr>
<td>Ledipasvir-Sofosbuvir x 12 weeks</td>
<td>$94,500</td>
</tr>
<tr>
<td>Sofosbuvir-Velpatasvir x 12 weeks</td>
<td>$74,760</td>
</tr>
</tbody>
</table>

*This 12-week regimen is for patients without baseline NS5A resistance-associated substitutions (at amino acid positions 28, 30, 31, or 93) for elbasvir

^This 8-week regimen is appropriate only for patients who are non-black, HIV-uninfected, and whose HCV RNA level is <6 million IU/mL
### Estimated Cost of Recommended Regimens for Initial Treatment HCV GT2

<table>
<thead>
<tr>
<th>Regimens and Duration of Therapy</th>
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<tr>
<td><strong>Genotype 2 HCV Without Cirrhosis</strong></td>
<td></td>
</tr>
<tr>
<td>Glecaprevir-Pibrentasvir for 8 weeks</td>
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<tr>
<td>Sofosbuvir-Velpatasvir for 12 weeks</td>
<td>$74,760</td>
</tr>
<tr>
<td><strong>Genotype 2 HCV With Compensated Cirrhosis</strong></td>
<td></td>
</tr>
<tr>
<td>Glecaprevir-Pibrentasvir for 12 weeks</td>
<td>$39,600</td>
</tr>
<tr>
<td>Sofosbuvir-Velpatasvir for 12 weeks</td>
<td>$74,760</td>
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</table>

*Cost estimates based on Wholesale Acquisition Cost (WAC)*
### Estimated Cost of Recommended Regimens for Initial Treatment HCV GT3

<table>
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<tr>
<td><strong>Genotype 3 HCV Without Cirrhosis</strong></td>
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<tr>
<td>Glecaprevir-Pibrentasvir for 8 weeks</td>
<td>$26,400</td>
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<td>Sofosbuvir-Velpatasvir for 12 weeks</td>
<td>$74,760</td>
</tr>
<tr>
<td><strong>Genotype 3 HCV With Compensated Cirrhosis</strong></td>
<td></td>
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<tr>
<td>Glecaprevir-Pibrentasvir for 12 weeks</td>
<td>$39,600</td>
</tr>
<tr>
<td>Sofosbuvir-Velpatasvir for 12 weeks</td>
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*Cost estimates based on Wholesale Acquisition Cost (WAC)*
## Estimated Cost of Recommended Regimens for Initial Treatment HCV GT4

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<th>Regimens and Duration of Therapy</th>
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<tr>
<td><strong>Genotype 4 HCV Without Cirrhosis</strong></td>
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<tr>
<td>Gleeprrevir-Pibrentasvir for 8 weeks</td>
<td>$26,400</td>
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<tr>
<td>Sofosbuvir-Velpatasvir for 12 weeks</td>
<td>$74,760</td>
</tr>
<tr>
<td>Elbasvir-Grazoprevir for 12 weeks</td>
<td>$54,600</td>
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<tr>
<td>Ledipasvir-Sofosbuvir for 12 weeks</td>
<td>$94,500</td>
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<tr>
<td><strong>Genotype 4 HCV With Compensated Cirrhosis</strong></td>
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<tr>
<td>Elbasvir-Grazoprevir for 12 weeks</td>
<td>$54,600</td>
</tr>
<tr>
<td>Ledipasvir-Sofosbuvir for 12 weeks</td>
<td>$94,500</td>
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*Cost estimates based on Wholesale Acquisition Cost (WAC)
**Figure 3 (Image Series) - Wholesale Acquisition Cost (WAC) for Initial Treatment of Chronic HCV Genotypes 1 to 6**

**Image 3E: Initial Treatment: Genotypes 5 or 6**

<table>
<thead>
<tr>
<th>Regimens and Duration of Therapy</th>
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<tbody>
<tr>
<td>Genotype 5 or 6 HCV Without Cirrhosis or With Compensated Cirrhosis</td>
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</tr>
<tr>
<td>Glecaprevir-Pibrentasvir for 8 weeks</td>
<td>$26,400</td>
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<td>Ledipasvir-Sofosbuvir for 12 weeks</td>
<td>$94,500</td>
</tr>
</tbody>
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*Cost estimates based on Wholesale Acquisition Cost (WAC)
Figure 4 General Principle of Incremental Cost-Effectiveness Ratio (ICER)

Incremental Cost-Effectiveness Ratio (ICER)

\[
\text{ICER} = \frac{(C_1 - C_0)}{(E_1 - E_0)}
\]

- \(C_1\) = cost in intervention group
- \(C_0\) = cost in control group
- \(E_1\) = effect in intervention group
- \(E_0\) = effect in control group
Figure 5 Incremental Cost-Effectiveness Ratio (ICER) with Hepatitis C Treatments

<table>
<thead>
<tr>
<th>Incremental Cost-Effectiveness Ratio (ICER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICER = ( \frac{(C_n - C_0)}{(QALY_n - QALY_0)} )</td>
</tr>
</tbody>
</table>

- \( C_n \) = cost of new hepatitis C therapy
- \( C_0 \) = cost of old hepatitis C therapy
- \( QALY_n \) = quality adjusted life years with new hepatitis C therapy
- \( QALY_0 \) = quality adjusted life years with old hepatitis C therapy
Figure 6 Cost Effectiveness Analysis of Treatment of HCV Genotype 1 with Ledipasvir-Sofosbuvir

The numbers shown on the bar graph represent the incremental cost-effectiveness ratio (ICER) in dollars per quality of life year (QALY) for treatment-naïve and treatment experienced patients with genotype 1 chronic HCV, including those with and without cirrhosis.