Evaluating HCV Screening, Linkage to Care, and Treatment Across Insurers

Karen Mulligan, PhD; Jeffrey Sullivan, MS; Lara Yoon, MPH; Jacki Chou, MPP, MPL; and Karen Van Nuys, PhD

ABSTRACT

OBJECTIVES: We examined how a population susceptible to hepatitis C virus (HCV) moves through the HCV screening and linkage-to-care (SLTC) continuum across insurance providers (Medicare, Medicaid, commercial) and identified opportunities for increasing the number of patients who complete the SLTC process and receive treatment.

STUDY DESIGN: Discrete-time Markov model.

METHODS: A cohort of 10,000 HCV-susceptible patients was simulated through the HCV SLTC process using a Markov model with parameters from published literature. Three scenarios were explored: baseline, in which each step required a separate visit and all infected saw a specialist; reflex, which reflexed antibody and RNA testing; and consolidated, which reflexed antibody, RNA, fibrosis staging, and genotype testing into 1 step, with an optional specialist visit. For each scenario, we estimated the number of patients lost at each stage, yield, and cost.

RESULTS: Streamlining the SLTC process by reducing the number of required visits results in more patients completing the process and receiving treatment. Among antibody-positive patients, 76% of those with Medicaid and 71% of those with Medicare and commercial insurance are lost to follow-up in baseline. In reflex and consolidated, these proportions fall to 26% and 27% and 4% and 5%, respectively. The cost to identify and link 1 additional infected patient to care ranges from $1586 to $2546 in baseline and $212 to $548 in consolidated. Total cost, inclusive of treatment, ranges from $1.0 million to $3.1 million in baseline and increases to $3.8 million to $15.1 million in reflex and $5.3 million to $21.0 million in consolidated.

CONCLUSIONS: Reducing steps in the HCV SLTC process increases the number of patients who learn their HCV status, receive appropriate care, and initiate treatment.

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Up to 3.5 million people in the United States are infected with chronic hepatitis C virus (HCV), and half are unaware of their infection status.[1,2] Current guidelines recommend 1-time HCV screening for individuals born between 1945 and 1965 and individuals with increased risk of infection, but initial screening represents only the first stage in the screening and linkage-to-care (SLTC) process.[3] To detect chronic infection, patients with a positive HCV antibody test must have confirmatory RNA testing, and for those with chronic HCV, additional diagnostics, including genotype testing and fibrosis staging, are recommended before treatment.

Reflex testing, in which RNA is tested immediately following a reactive antibody test using the same blood draw, represents a simplified SLTC process and allows patients to definitively know their HCV status following 1 visit.[4] Without reflex testing, an estimated 33% to 47% of patients who receive a positive antibody test do not receive confirmatory RNA testing, highlighting the importance of a streamlined process for patient awareness.[5-7]

Although fewer visits in the SLTC process may result in fewer patients lost to follow-up, other barriers may result in patients dropping out of the process prior to initiating treatment. For example, HCV guidelines still recommend subspecialty consultation for patients with advanced fibrosis or cirrhosis.[3] The need for specialty care may disproportionately impact patients with less access to care, such as those who use community health centers.[8,9] Even if patients successfully complete all screening and diagnostic testing and receive a prescription for treatment, they still may not be treated if their payer policy includes coverage restrictions, such as prior authorization (PA).[10]

Given that only 16% of chronically infected patients are eventually prescribed treatment,[11] it is important to identify steps in the SLTC process where patient retention is lowest and improve retention at those points. To examine this issue, we developed a model that simulates the HCV SLTC process from antibody testing through treatment initiation. The minimum number of visits required prior to a treatment decision varied from 2 to 4, and the resulting costs, yield, and patients lost to follow-up were estimated depending on patients' insurance provider (Medicaid, Medicare, or commercial).

TAKEAWAY POINTS

This study evaluated the impact of streamlining the hepatitis C virus (HCV) screening and linkage-to-care (SLTC) process on costs, yield, and patients lost to follow-up by integrating reflex testing for early steps in the process. The findings are relevant for clinicians and managed care decision makers involved in HCV SLTC programs.

- Reducing the number of required visits during the SLTC process decreases the number of patients lost to follow-up by 62% to 95%.
- Streamlining the HCV SLTC process results in more patients who are aware of their HCV status, receive appropriate care, and are ultimately treated.

STUDY DESIGN AND METHODS

Baseline Model Framework

A discrete-time Markov model was developed to simulate the HCV SLTC process and was stratified by insurance type: Medicaid, Medicare, and commercial. The model follows 10,000 patients from antibody screening through treatment initiation until 1 of 5 conditions is met: (1) they are found not to have chronic HCV, (2) a "no treatment recommended" decision is made, (3) PA is denied, (4) treatment is initiated, or (5) they drop out before meeting any of the prior conditions and are lost to follow-up (henceforth, "lost").

The state transition model (**Figure 1**) was adapted from CDC guidance.[4] Patients enter the model and receive an antibody test. Those who are antibody-negative are not infected with HCV, require no additional testing, and have completed the SLTC process. Patients who are antibody-positive (Ab+) continue to confirmatory RNA testing or are lost.

RNA testing assesses the presence of chronic infection. Patients who are RNA-negative have no active infection and have completed the screening process. Patients who test RNA-positive and have been infected longer than 6 months are chronically infected and continue to a specialist for further testing or are lost.

Patients with chronic HCV receive genotype testing and noninvasive liver fibrosis staging at a specialist visit; results determine their treatment regimen and duration. Biopsies account for fewer than 10% of fibrosis staging tests[12] and were excluded from our model. At this stage, patients either receive a "no treatment recommended" decision, are prescribed treatment, or are lost. Patients who receive a decision of no treatment recommended have completed the screening process.

If treatment is recommended, patients transition through additional stages before receiving therapy. We do not explicitly model additional tests that may follow the treatment recommendation, such as NS5A resistance testing or renal function testing; however, such tests could be conducted during the specialist visit, which avoids additional visits during the SLTC process. At least 29 states require some duration of sobriety for Medicaid patients.[13] Therefore, Medicaid enrollees in our model must meet sobriety requirements and obtain PA before initiating treatment. Commercial and Medicare enrollees must obtain PA.

Model parameters were drawn from the published literature and stratified by insurance type where possible. Key parameters for the model include transition probabilities, average timing values, and per visit costs. HCV prevalence plays a key role in model outcomes because it determines the number of Ab+ patients who progress beyond the initial state. Of our 3 insurance strata, Medicaid has the highest prevalence of Ab+ patients (16%), followed by Medicare (9%) and commercial (5%).[14,15] The proportion of Ab+ patients with chronic HCV is the same for all strata (79.7%).[16] The **eAppendix** (available at **ajmc.com**) provides a full description of the model assumptions and parameters.

Model Scenarios

The baseline scenario previously described requires at least 4 visits before chronically infected patients receive a treatment recommendation (Figure 1). We also estimated reflex and consolidated scenarios in which chronically infected patients require a minimum of 3 or 2 visits, respectively, before treatment recommendation. All stages of the SLTC process in baseline are included in reflex and consolidated, but they are condensed to varying degrees. Beyond the treatment decision step, the 3 scenarios are identical.

Baseline includes the SLTC steps recommended in current HCV guidelines, with each step in the process requiring a separate visit and only specialists providing genotype testing, fibrosis staging, and treatment decisions. Baseline thus requires 4 visits for a chronically infected patient to receive a treatment recommendation and is the least efficient scenario.

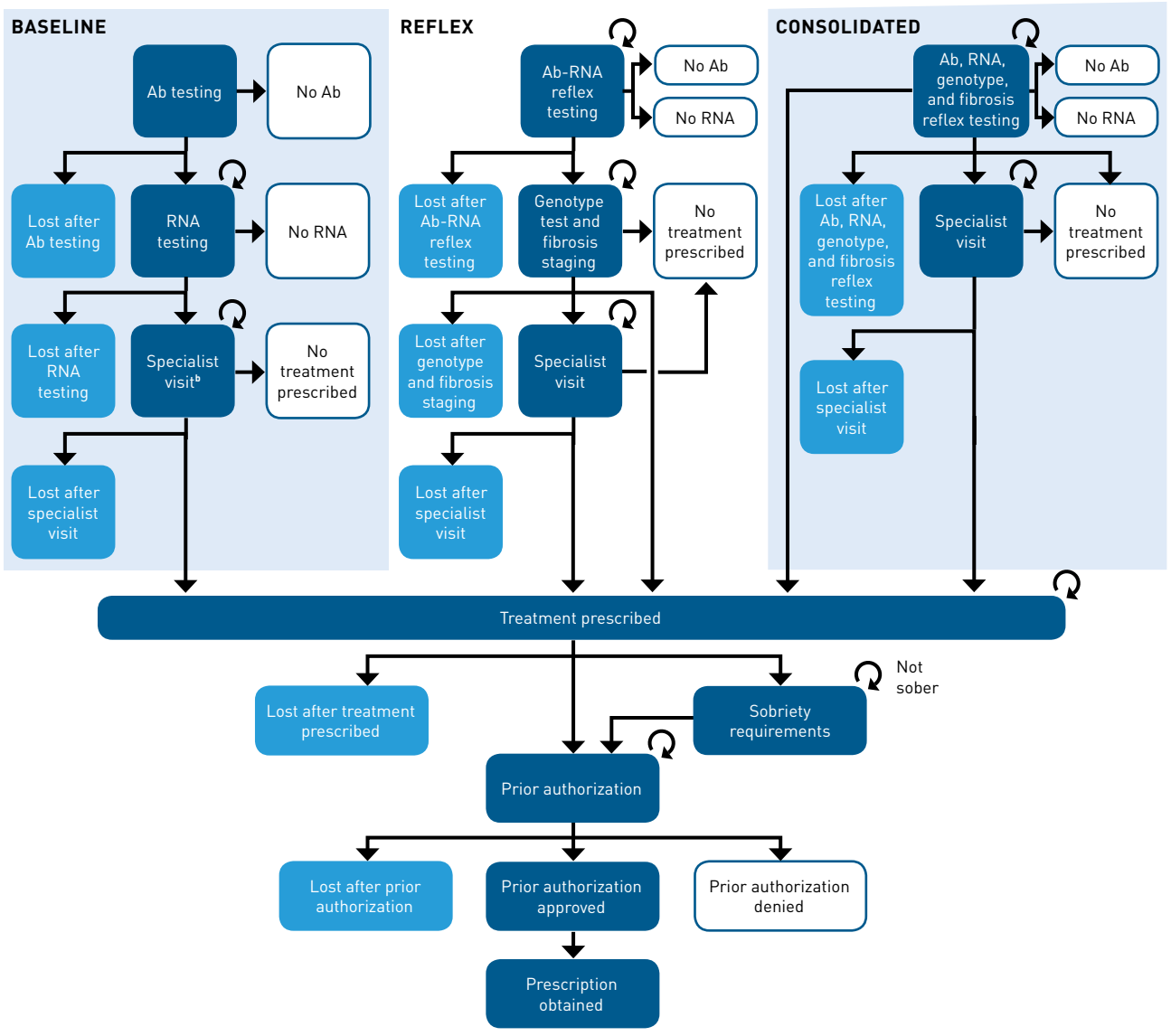
Reflex also includes the SLTC steps recommended in current HCV guidelines, but reflexes antibody and RNA testing so that 2 blood samples are collected from a single draw at the first visit and if the first is Ab+, the second is automatically tested for HCV RNA.[17,18] Thus, the process can be completed in 3 visits rather than 4.

Reflex also eliminates the specialist visit for less clinically complex patients who can be effectively managed by primary care physicians (PCPs). To be conservative, we assumed that only patients with fibrosis scores below F2 can be managed by PCPs, which resulted in 60% of patients requiring a specialist visit.[19]

Consolidated represents a hypothetical best-case scenario in which all tests are reflexed and a specialist visit is not required for patients with fibrosis scores below F2. This scenario requires at least 2 visits for chronically infected patients to receive a treatment decision and provides the fewest opportunities for patients to be lost.

Although pangenotypic treatment is now available, guidelines still recommend genotype testing, and all 3 scenarios include it. Genotype testing can also be used to guide treatment for patients who do not receive pangenotypic treatment. To reflex noninvasive fibrosis staging, diagnostic tests using a blood draw (eg, AST [aspartate aminotransferase] to Platelet Ratio Index or FibroTest) would be required.[20] Although these may be uncommon as the primary means for fibrosis staging in current practice, they are feasible.

FIGURE 1. Model Schematics[a]



Ab indicates antibody.

[a]The clockwise arrow symbol indicates that a patient has completed the step and is waiting to progress to the next step.

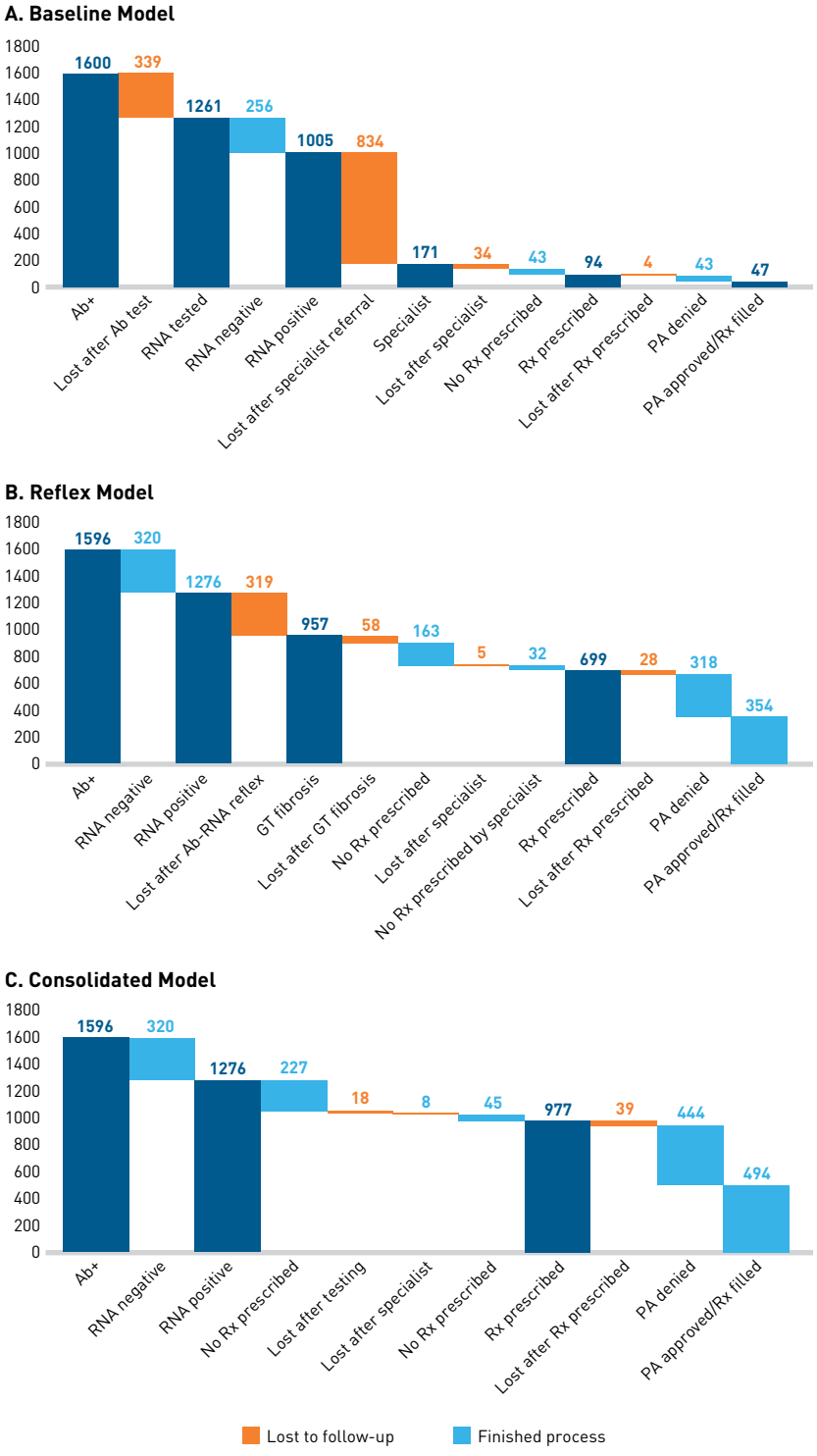
[b]Specialist visit includes genotype test and fibrosis staging.

Current HCV treatment guidelines recommend combined blood- and image-based fibrosis testing, so our consolidated scenario should be considered exploratory, as an estimate of potential benefits from an SLTC process that minimizes patient visits.[3]

Model Outcomes

We estimated several outcomes for each scenario and insurance type: number of patients lost at each stage, yield (percentage of patients entering the model who complete the process and initiate treatment), conditional yield (percentage of patients with chronic HCV who complete the process and initiate treatment), and several cost outcomes. Total screening costs include the cost of antibody testing, RNA testing, genotype testing, fibrosis staging, and, when relevant, specialist and sobriety costs. Total costs include screening costs plus the cost of treatment. We assumed that treatment cost equals the wholesale acquisition cost of sofosbuvir 400 mg/velpatasvir 100 mg (Epclusa) discounted by 46%.[3] To estimate the cost to identify and link 1 additional patient to care, we calculated the number of patients screened to yield 1 patient in the genotype/fibrosis step of the model and calculated the cost of antibody and RNA testing for those patients. This outcome provides an additional measure of efficiency of the SLTC process prior to receiving a treatment

FIGURE 2. Baseline, Reflex, and Consolidated Models of the HCV SLTC Process for Medicaid Patients[a]



Ab+ indicates antibody positive; HCV, hepatitis C virus; GT, genotype; PA, prior authorization; Rx, prescription; SLTC, screening and linkage-to-care.

[a]The Ab+ rate in baseline is actually the result of 2 model transitions, as seen in Figure 1, while the reflex and consolidated rates are not. Rounding in the parameter estimates thus yields slightly different numbers of Ab+ patients, but the population sizes are qualitatively the same.

recommendation and is independent of the number of patients treated. Other outcomes are presented in the eAppendix, including cost per person screened, timing-related results, and yield conditional on the number of Ab+ patients.

RESULTS

Lost to Follow-Up and Yield

SLTC results for each strata and scenario are presented in **Figures 2**, **3**, and **4**. The figures show the number of patients lost after each step; fewer patients lost indicates a more efficient process. In baseline, 12% of Medicaid, 6% of Medicare, and 4% of commercial patients are lost before treatment. Across all insurance types, most patients are lost after RNA testing. For reflex and consolidated, 4.0% and 0.7%, respectively, are lost before treatment for Medicaid, 2.0% and 0.5% for Medicare, and 1.0% and 0.3% for commercial patients.

Yield and total lost results are presented in the **Table**. Yield incorporates both HCV prevalence in the screened population and the likelihood of loss. High yields therefore result from high prevalence, screening process efficiency, or both. Baseline yields are 0.5%, 0.7%, and 0.2% for Medicaid, Medicare, and commercial patients, respectively. The higher efficiency of the reflex and consolidated models translates into higher yields; reflex yields are 3.5%, 3.1%, and 0.9%, respectively, and 4.9%, 4.4%, and 1.2% in consolidated.

Conditional yield describes the efficiency of the screening process for chronically infected patients. Baseline conditional yields are 4%, 9%, and 5% for Medicaid, Medicare, and commercial, respectively, increasing to 28%, 44%, and 22% in reflex and 31%, 49%, and 24% in consolidated.

Costs

The Table also presents total costs, total screening costs, screening costs per patient treated, and the cost to identify 1 additional patient and link them to care. We used undiscounted costs in our model; therefore, our cost results represent an upper bound.

Total costs are driven by the total treated, and in baseline are highest for Medicare ($3.1 million) and lowest for commercial ($1.0 million); total costs increase substantially for reflex and consolidated, ranging from $3.8 million to

$15.1 million and $5.3 million to $21.0 million, respectively. Although commercial has the lowest total screening cost, it also treats the fewest patients, leading to higher per person costs. In baseline, the cost per person treated is $7843 for Medicaid, $4833 for Medicare, and $14,176 for commercial.

For baseline, the cost to identify 1 additional chronically infected patient and link them to care is highest in the commercial population ($2546) and lowest in the Medicare population ($1539), but Medicaid sees the largest reductions in that cost when the process is collapsed from baseline to reflex or consolidated.

Alternative Analyses

Three alternative analyses were conducted: (1) "fixed prevalence," which assumed the same HCV Ab+ prevalence across insurance types; (2) "no genotype," which removed genotype testing; and (3) "no sobriety requirements," which removed sobriety requirements. Results for alternative analyses are presented in the eAppendix.

"Fixed prevalence" allows us to compare the efficiency of the SLTC process across insurance types while holding constant population disease prevalence. Commercial has the highest per person costs in the main analysis, but Medicaid and commercial costs are similar in the fixed prevalence analysis, suggesting that lower per person costs in Medicaid are driven primarily by higher prevalence.

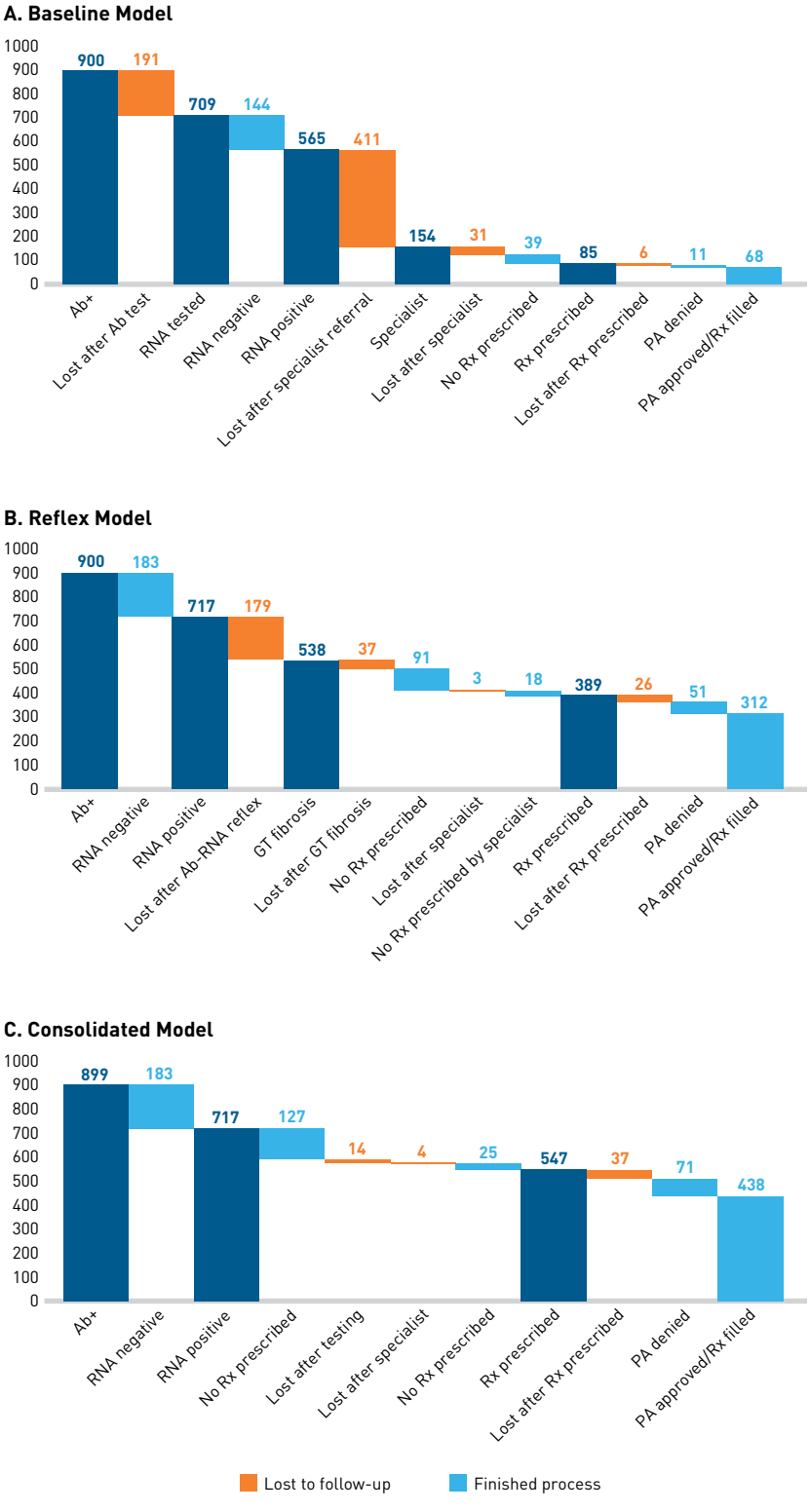
Although genotype testing is still recommended in HCV treatment guidelines, "no genotype" explores the impact of removing genotype testing, which may be possible with pangenotypic therapies. Because genotype testing occurs during the same visit as fibrosis staging, removing it reduces per person costs by $351 but does not reduce visits.

"No sobriety requirements" removes a barrier to treatment initiation that occurs late in the SLTC process and affects only the Medicaid population. Removing sobriety testing reduces screening costs by $48 per drug test.

DISCUSSION

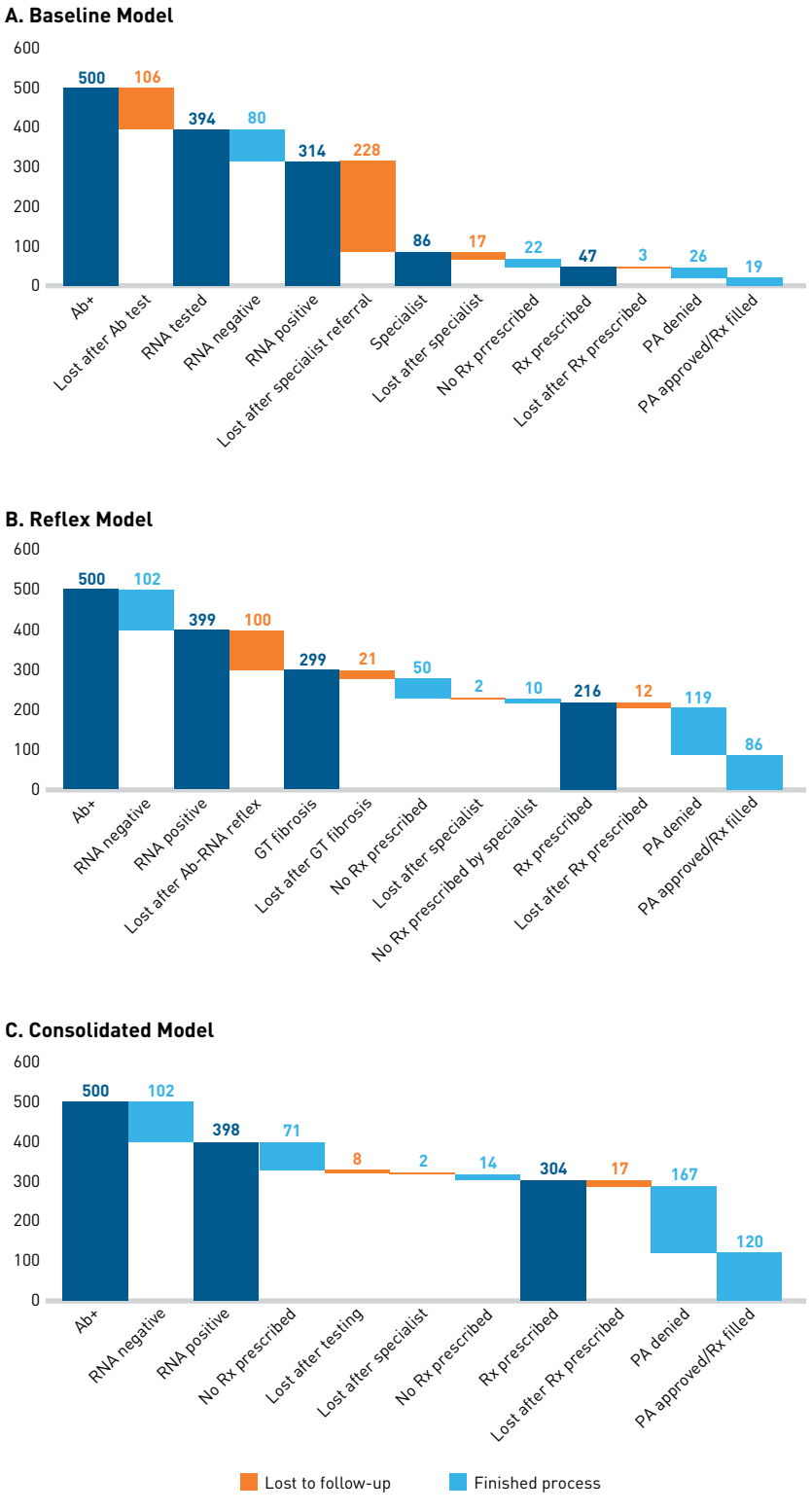
Comparing baseline, reflex, and consolidated results shows the value of streamlining the SLTC process. Collapsing baseline to reflex reduces the number of patients lost prior to receiving

FIGURE 3. Baseline, Reflex, and Consolidated Models of the HCV SLTC Process for Medicare Patients



Ab+ indicates antibody positive; HCV, hepatitis C virus; GT, genotype; PA, prior authorization; Rx, prescription; SLTC, screening and linkage-to-care.

FIGURE 4. Baseline, Reflex, and Consolidated Models of the HCV SLTC Process for Commercially Insured Patients



Ab+ indicates antibody positive; HCV, hepatitis C virus; GT, genotype; PA, prior authorization; Rx, prescription; SLTC, screening and linkage-to-care.

a treatment recommendation by 62% to 66%. Further streamlining to consolidated reduces the number lost by 92% to 95%. Because the Medicaid population has the most inefficient SLTC process to begin with, it experiences the largest improvements from streamlining the process.

Although our analysis focuses on the number of visits as a measure of SLTC process efficiency, the underlying prevalence in a given population also plays an important role in the process. For example, although the Medicaid subpopulation loses the most patients, it also has the highest Ab+ prevalence (16%), resulting in higher yield versus the commercial population. Moreover, in consolidated, only 20 additional Medicaid patients need to be screened on average to get 1 additional chronically infected patient into treatment compared with 100 additional patients screened to achieve the same result in the commercial population.

Our findings are consistent with those of a recently published study of the care continuum for patients with HCV diagnosed in 2 urban emergency departments.[21] In the study, the Medicaid process was less efficient, with only 8.5% of RNA-positive patients initiating treatment compared with 12% of Medicare patients. Additionally, 82% of Ab+ patients completed viral load testing, similar to our finding of approximately 80% of patients progressing to RNA testing. Generally, the literature presents conditional yield rather than yield; conditional yield estimates range from 3.9% to 24%.[11,14,22-24] Our baseline conditional yields (3.7%-9.5%) are on the lower end compared with recent studies. Our baseline Ab+ conditional yields (eAppendix) range from 2.7% to 7.5%, which is consistent with findings from 2 recent studies (3.3% and 4.0%).[25,26]

Not surprisingly, total costs increase dramatically from baseline to reflex and consolidated, because more patients receive treatment. This paper is not intended as a cost-benefit exercise, nor do we model other medical expenditures for patients with HCV. However, the increased treatment costs are arguably of high value because identifying and treating more patients will provide benefits associated with reduced transmission rates, long-term cost savings on medical expenditures related to untreated HCV, and a reduction in liver transplants.[27-29]

Reducing the number of patients lost decreases screening costs per person treated because the total system costs are spread among more patients. This aligns with prior literature showing that expanded HCV screening provides the most value when coupled with expanded treatment.[30] Additionally, there are costs associated with the SLTC process that are difficult to measure (eg, patient navigation, social work) and are not included in our analysis. It is likely that Medicaid patients would benefit most from these services and incur additional costs, but this population also experiences the greatest gains from reflex and consolidated.

For all insurance types, a majority of patients are lost prior to visiting a specialist, which suggests that having insurance does not eliminate inefficiencies associated with multiple visits required in the SLTC process. Although our 3 scenarios focus on streamlining the SLTC process prior to treatment recommendation, barriers to treatment exist in later stages of the process. Specifically, PA poses a significant barrier for patients who are prescribed treatment, particularly in the Medicaid and commercial populations. Of patients who seek PA, 46% and 55% of Medicaid and commercial patients, respectively, are denied, whereas only 13% of Medicare patients are denied.

A patient who is denied PA is comparable with one who is lost, and for patients who are eventually denied, streamlining the process simply delays the point at which they are lost. This delay increases overall costs from screening and time spent in the process but does not change the disease outcome because treatment is not received. Consequently, to maximize the number of patients treated, barriers to treatment must be reduced.

TABLE. Screening Process Outcomes for a Cohort of 10,000 Patients Entering HCV SLTC, by Insurance Type and Model Scenario[a]

		Medicaid	Medicare	Commercial
Number of patients lost to follow-up (% of Ab+)	Baseline	1211 (76%)	639 (71%)	353 (71%)
	Reflex	410 (26%)	245 (27%)	135 (27%)
	Consolidated	65 (4%)	54 (6%)	27 (5%)
Yield	Baseline	0.5%	0.7%	0.2%
	Reflex	3.5%	3.1%	0.9%
	Consolidated	4.9%	4.4%	1.2%
Conditional yield (RNA-positive patients)	Baseline	3.7%	9.5%	4.8%
	Reflex	27.7%	43.5%	21.6%
	Consolidated	38.7%	61.1%	30.2%
Required patients screened (n) to get 1 additional patient with HCV into treatment	Baseline	200	143	500
	Reflex	29	32	111
	Consolidated	20	25	100
Total cost (cost of screening)	Baseline	$2.3 million ($368,598)	$3.1 million ($328,648)	$1.0 million ($269,337)
	Reflex	$15.1 million ($819,606)	$13.1 million ($523,952)	$3.8 million ($377,585)
	Consolidated	$21.0 million ($1,012,774)	$18.3 million ($628,475)	$5.3 million ($436,164)
Cost of screening per person treated	Baseline	$7843	$4833	$14,176
	Reflex	$2324	$1680	$4430
	Consolidated	$2059	$1446	$3615
Cost to identify 1 additional chronically infected patient and link to care	Baseline	$1586	$1539	$2546
	Reflex	$283	$441	$730
	Consolidated	$212	$331	$548

Ab+ indicates antibody-positive; HCV, hepatitis C virus; SLTC, screening and linkage to care.

[a]Yield is the percentage of the full cohort of 10,000 patients entering the model for HCV antibody screening who complete the process and initiate treatment. All costs are in 2016 US$. Total cost includes the cost of screening and cost of treatment. Cost of screening includes the cost of the antibody test, RNA test, genotype test, noninvasive fibrosis staging, and, when applicable, a specialist visit and/or sobriety requirements.

Limitations

We note several limitations. Our parameter values come from the literature and were not available for all insurance types in many cases. Some of our parameters may not be generalizable because they are derived from small samples or high-risk subpopulations. In cases where required parameter values were unavailable, we relied on assumptions, detailed in the eAppendix, to populate the model.

Although the consolidated scenario demonstrates the value of streamlining the SLTC process, it represents a hypothetical process. Novel real-world screening models, such as Project ECHO, attempt to achieve similar efficiency gains through telemedicine, but they have not been broadly adopted.[31] Additionally, the decision to initiate treatment is a dynamic one (ie, patients who are not initially recommended for treatment may receive a treatment recommendation later). Because we model "no treatment recommended" as an absorbing state, we do not capture the dynamics of the treatment recommendation decision and therefore underestimate the number of patients who ultimately initiate treatment, as well as the costs.

Although our model captures key screening steps and barriers related to obtaining treatment, it relies, like all models, on simplifications and abstractions that may not generalize. For example, we do not consider variability within insurers; our classification of a single broad "commercial" stratification does not allow for the effect of plan-specific features, such as narrow networks, on the SLTC process. We also do not consider the site where patients are screened or the composition of patients receiving screening, both of which may impact screening outcomes. Our assumption that fibrosis staging can be reflexed could result in some patients' fibrosis scores being misclassified because blood tests are not sensitive enough to rule out substantial fibrosis.[20,32,33]

Finally, we do not explicitly model capacity constraints, but we model wait times between stages. Explicitly including capacity constraints would further affect patient wait times between stages,

particularly in consolidated, which assumes that the entire SLTC process occurs at a single site.

Future research should focus on identifying opportunities to improve the STLC process for patients across screening sites and insurance providers, as well as collecting more granular real-world data for the SLTC process. Other real-world features should be considered, such as the decision to enter screening, dynamic treatment recommendations, and capacity constraints. Finally, it will be useful to understand the relative importance of other mechanisms for improving SLTC process efficiency, such as patient navigation, decreased wait times between appointments, and conducting all HCV screening and additional care at 1 location.

CONCLUSIONS

Substantial advances in treatment have improved the outlook for patients with HCV, but continuing efforts are needed to increase the number of patients who complete the SLTC process. Appropriate care can increase the number of patients screened, evaluated, and treated for, and cured of, HCV. Initiatives to address the efficiency of the SLTC process should be tailored to reflect nuances in different insurance populations and access to resources. Our findings highlight the importance of removing inefficiencies in the early SLTC stages (eg, antibody and RNA testing). However, consolidating the early part of the SLTC process is not sufficient because patients also encounter barriers later, usually at the PA stage. Reducing the number of visits required to obtain treatment, as well as removing other barriers, will increase the number of patients who obtain treatment. ■

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Author Affiliations: Sol Price School of Public Policy and Schaeffer Center for Health Policy and Economics at the University of Southern California (KM); Precision Health Economics (JS, LY, JC), Los Angeles, CA; Value of Life Sciences Innovation Project, Schaeffer Center for Health Policy and Economics at the University of Southern California (KVN), Los Angeles, CA.

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Authorship Information: Concept and design (KM, JS, LY, KVN); acquisition of data (KM, LY); analysis and interpretation of data (KM, JS, KVN); drafting of the manuscript (KM, LY, JC, KVN); critical revision of the manuscript for important intellectual content (KM, JS, JC, KVN); statistical analysis (JS); administrative, technical, or logistic support (JC); and supervision (KVN).

Address Correspondence to: Karen Mulligan, PhD, Precision Health Economics, 11100 Santa Monica Blvd, Ste 500, Los Angeles, CA 90025. Email: karenmul@usc.edu.

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Evaluating HCV Screening, Linkage to Care, and Treatment Across Insurers

eAppendix

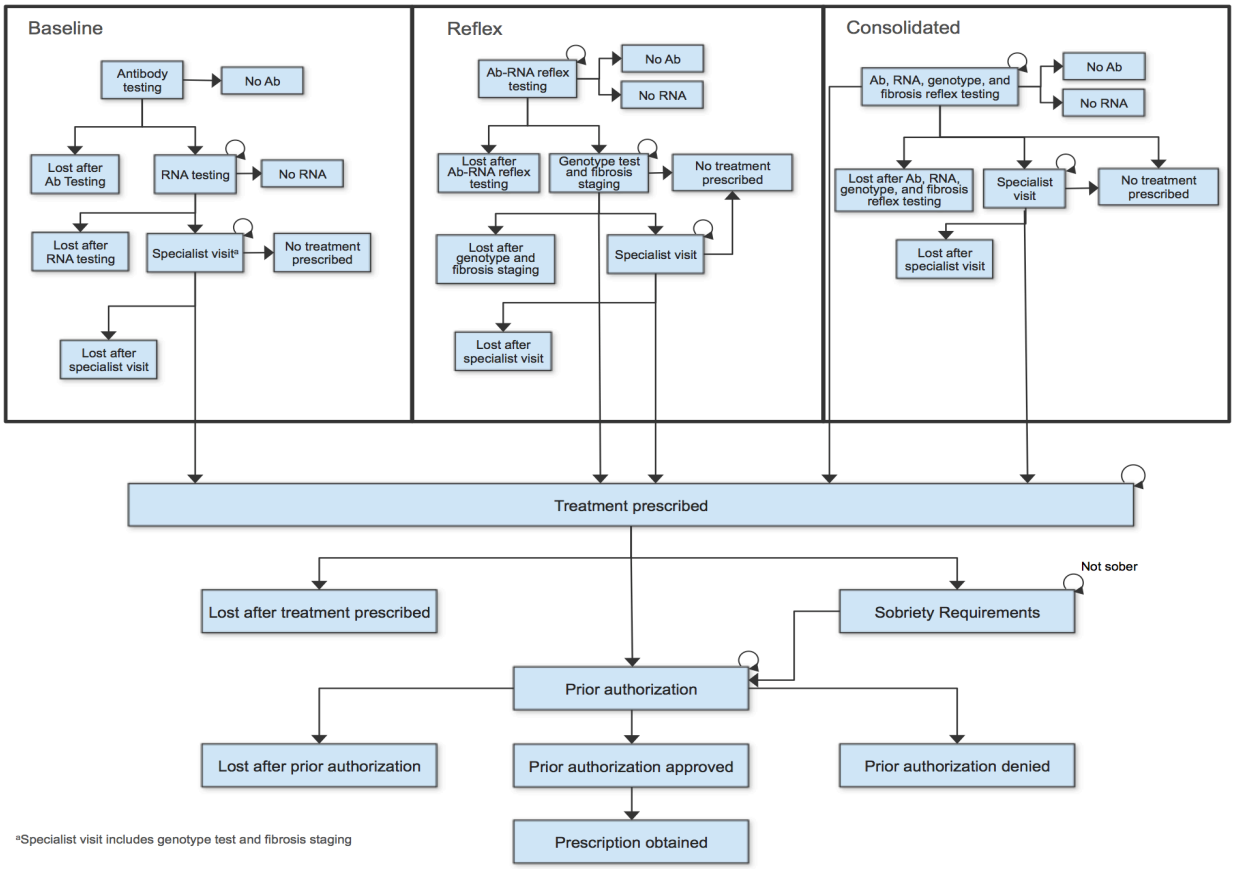
1. Conceptual model

Current guidelines recommend a 1-time screening for hepatitis C virus (HCV) for individuals born between 1945 and 1965 and individuals with increased risk of HCV infection, but initial screening only represents the first stage in the screening and linkage-to-care (SLTC) process.[1] The SLTC process includes: an initial HCV-antibody test, confirmatory RNA testing for patients who test positive for HCV antibodies, and additional diagnostics for those who test RNA positive, which means the patient has chronic HCV. Additional diagnostics include genotype testing and fibrosis staging. Whether a specialist is required in the SLTC is a function of patient fibrosis stage since current guidelines still recommend subspecialty care and consultation for patients with advanced fibrosis or cirrhosis.[1] Later stages in the SLTC process may include meeting sobriety requirements or prior authorization (PA), which depend on insurance status. We developed a discrete time Markov model to simulate the HCV SLTC process, and estimate three model scenarios as described in Section 2. Model states were adapted from HCV management and treatment guidance for clinicians and laboratorians published by the Centers for Disease Control and Prevention (CDC).[2] A cohort of 10,000 patients begins in the initial antibody screening stage, and patients are followed until they complete the screening process or are lost to follow-up (henceforth "lost").

2. Model scenarios and outputs

We estimated three model scenarios, altering the minimum number of visits required to obtain a treatment recommendation: Baseline, Reflex, and Consolidated. Baseline requires four visits for a patient with chronic HCV to receive a treatment decision, and represents the least efficient screening process compared to the two scenarios with fewer visits. In Reflex, chronically infected patients require a minimum of three visits for a treatment decision, and in Consolidated, a minimum of two visits is required. Each model cycle is 1 week, and we do not include mortality in the model.

Figure 1. Model Schematics



2.1. Baseline scenario

The Baseline scenario states and transitions are shown in Figure 1, and it was adapted from the guidance for clinicians and laboratorians published by the Centers for Disease Control and Prevention (CDC).[2] The Baseline model includes the SLTC steps recommended in the current HCV guidelines, in which each step in the screening process requires an entirely separate visit and patients must receive their treatment decision from a specialist. All patients are required to see a specialist for genotype testing and fibrosis staging.

We assume a cohort of patients enter the model and receive an antibody test. Patients who are HCV antibody-negative have not been exposed to HCV and do not require additional testing; they are therefore considered to have completed the screening process. Patients who are antibody-positive (Ab+) have been exposed to HCV, but their disease status is as yet unknown. They either continue to HCV RNA testing or are lost.

The second stage in the screening process is HCV RNA testing for patients who have tested Ab+. RNA testing is the confirmatory, definitive test for the presence of active disease.

Patients who are HCV RNA-negative do not have active disease, require no further testing, and are considered to have completed the screening process. Patients who test HCV RNA-positive have chronic HCV, and either continue to a specialist visit for further testing or are lost.

In the specialist visit stage, chronically infected patients are tested for genotype and receive non-invasive liver fibrosis staging. At this stage, patients receive a 'no treatment recommended' decision, or prescription for HCV treatment, or are lost. Patients who receive a 'no treatment recommended' decision have completed the screening process.

Once a treatment recommendation is provided and a prescription for medication is written, patients must transition through additional stages before receiving actual drug therapy. Preliminary findings from the National Viral Hepatitis Roundtable (NVHR) show that at least 29 states require some degree of sobriety, ranging from 1-12 months.[3] Medicaid patients must meet sobriety requirements to confirm they are not active users. Once patients have passed the requirement, they must obtain PA before they receive treatment. Medicare and commercial patients do not face sobriety requirements, but they must obtain PA from their health plans before they receive treatment. Patients who reach the PA stage are either denied, approved, or lost to follow-up. Patients who are denied PA may submit an appeal. Rather than model the appeals process explicitly, we generated the final set of PA-related transition probabilities for patients who are approved, denied, or lost based on the final decisions after appeal in our data. Patients who are denied PA are assumed to have completed the screening process. Patients who are approved for PA initiate treatment in the next model cycle. We assume no patients who are approved for prior authorization are lost.

2.2. Reflex scenario

Reflex (shown in Figure 1) also includes the SLTC steps recommended in the current HCV guidelines, but introduces reflex testing for the antibody and HCV RNA tests (that is, two blood samples are drawn at the first visit, and if the first sample is Ab+, the second sample is automatically tested for HCV RNA without requiring a separate visit and blood draw).[5,6] By consolidating these two steps with reflex testing, it is possible to complete Reflex in 3 visits rather than 4.

Reflex also assumes patients receive genotype testing and fibrosis staging prior to an optional specialist visit. Rather than use cirrhosis as the cutoff for complex cases, we assumed

patients with fibrosis scores below F2 are less complex to be conservative in our estimate of the number of patients who do not see a specialist. The Kaiser Permanente Mid-Atlantic States[5] (KPMAS) screening pathway provides 1 example of using F2 as a cutoff value in the SLTC. Although the KPMAS pathway does require all patients who initiate treatment to see a specialist, patients with fibrosis below F2 see a PCP for monitoring and those with scores F2 or higher see a specialist. In our model, if a patient does not require a specialist visit, then their treatment recommendation is given by a PCP. We assume 60% of patients require a specialist visit.[8] All states in Reflex after the treatment recommendation are the same as in Baseline.

2.3. Consolidated scenario

Consolidated is shown in Figure 1 and represents a hypothetical "best case" scenario, in which all tests (antibody, RNA, fibrosis staging, and genotype testing) are reflexed and a specialist visit is only required for patients with fibrosis score F2 or higher. All states in Consolidated after the treatment recommendation are the same as in Baseline. This scenario requires a minimum of 2 visits for chronically infected patients to receive a treatment decision, and therefore provides the fewest opportunities for patients to be lost before completing the screening process.

3. Model parameters and outcomes

3.1. Transition parameters

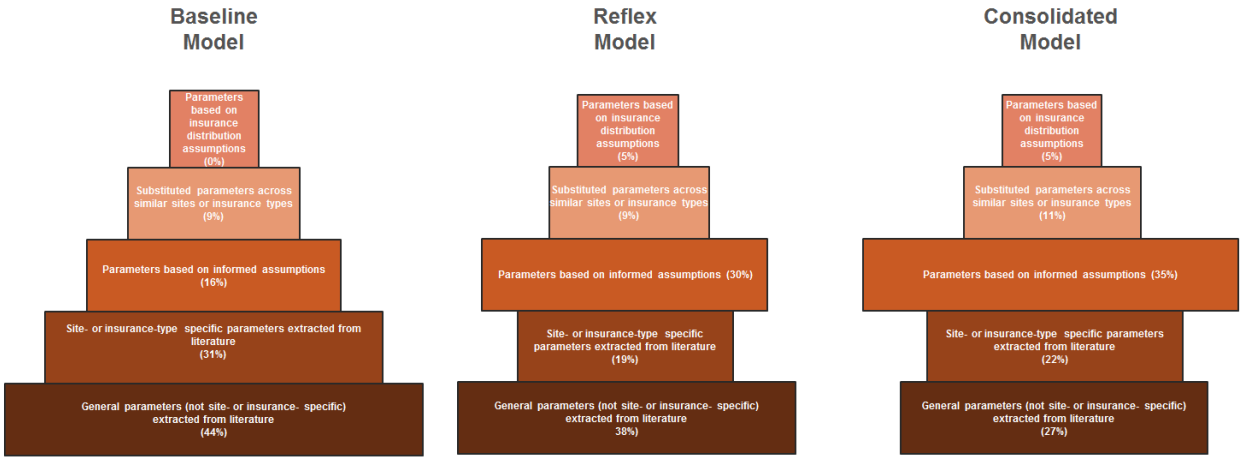
3.1.1. Baseline Scenario

Baseline required estimates for 30 different transition probabilities. A hierarchy was used in selecting model parameters which would allow for insurance stratifications, or that represented the population more generally. The specific hierarchy for selecting model transition parameters is as follows: 1) insurance-type specific parameters; 2) general parameters (ie not specific to any insurance); 3) substituted parameters across similar insurance types; and 4) parameters based on informed assumptions.

While ideally, we would select parameters based on this hierarchy alone, to construct and run a model that would produce results, it was necessary to assure that the transition parameters leading out of a model state summed to 1.0. This requirement implied that combining parameters from different references could potentially violate mathematical constraints. In order to mitigate this possibility, we attempted to identify 1 published source that contained multiple

parameters in the screening process. When we had to select parameters piecewise across different sources, we selected parameters that did not violate the summing-to-one constraint. Each transition matrix was normalized to account for small differences resulting from numerical precision.

Figure 2. Visual distribution of Parameter Sources for Baseline, Reflex, and Consolidated



3.1.2. Reflex and Consolidated scenarios

Transition parameters for the first steps of the Reflex and Consolidated models were generally not available in the literature due to the slow adoption of reflex testing in sites other than the VA; therefore, transition parameters were derived using Baseline parameters and assumptions. We assumed HCV prevalence is not impacted by reflex testing; we therefore used prevalence parameters from Baseline in Reflex and Consolidated. Second, we assumed the proportion of patients lost in Reflex and Consolidated should be lower relative to Baseline since these scenarios do not require a specialist visit. Accordingly, we modified the Baseline parameters for Reflex and Consolidated as described in Section 3.1.2.1.

Table 1. Summary of Model Scenarios and Steps

	Baseline – Worst Case *(4-visit minimum)*	***Reflex – Moderate Case*** *(3-visit minimum)*		***Consolidated – Best Case*** *(2-visit minimum)*	
		Fibrosis: F0-F1	Fibrosis: F2+	Fibrosis: F0-F1	Fibrosis: F2+
Step 1	Ab testing[a]	Ab testing with HCV RNA reflex testing[b]		"Visit 1": Ab testing with reflex HCV RNA testing, followed by reflex GT testing and fibrosis staging (no specialist required)[c]	

Step 2	HCV RNA testing Lost parameters from literature	Genotype test and fibrosis staging (no specialist required)[d]		Treatment recommendation[e] from PCP	Specialist visit
Step 3	Specialist visit (including genotype test and fibrosis staging)[f]	Treatment recommendation[e] from PCP	Specialist visit		Treatment recommendation[e] from specialist[g]
Step 4	Treatment recommendation[e]		Treatment recommendation[e] from specialist[g]		

Notes: [a]Lost parameters from Armstrong et al.[4]; [b]Lost parameter from Jonas et al[5]; [c]Lost parameter calculated using Reflex Model genotype lost parameter and Baseline Model parameters. See equations (1)-(3).; [d]Lost parameter calculated using Baseline Model parameters and Jonas et al[5] See equations (1)-(2).; [e]Treatment recommendation includes both "No prescription" and "Treatment prescribed"; [f]Lost parameter from Butt et al[6]; [g]Lost parameter equal to 0.01 by assumption.

3.1.2.1. Reflex and Consolidated Lost Parameter Derivations

For Baseline, we defined the lost parameters associated with steps 1 and 2 in Table 1 as:

$$P(X_{t+1} = Lost | X_t = RNA\ Test)^i = proportion\ lost\ after\ RNA\ testing\ for\ site/insurer\ i$$

$$P(X_{t+1} = Lost | X_t = Specialist\ Visit)^i = proportion\ lost\ after\ specialist\ visit\ for\ site/insurer\ i$$

The RNA test (step 1) and specialist visit (step 2) in Baseline are analogous to Ab-RNA reflex testing and genotype/fibrosis staging in Reflex, respectively. Similarly, step 1 in Baseline is analogous to "Visit 1" (ie, fully reflexed Ab-RNA-genotype-fibrosis) in Consolidated. The lost parameter that corresponds to Ab-RNA reflex testing in Reflex is available in the literature (25% according to Jonas et al).[5]

However, the lost parameter associated with genotype/fibrosis staging in Reflex is not available in the literature, nor is the lost parameter that corresponds to "Visit 1" for

Consolidated. We derive these two missing parameters using analogous lost parameters from Baseline, which were available in the literature.

3.1.2.1.1. Reflex scenario: proportion lost after genotype/fibrosis staging

According to Jonas et al[5], 25% of patients are lost after Ab-RNA reflex testing (before receiving genotype testing and fibrosis staging). We therefore define the lost parameter following Ab-RNA reflex testing (ie, step 1 in Table 1) for Reflex:

$$P(X_{t+1} = Lost|X_t = AbRNA)^i = proportion\ lost\ after\ AbRNA\ reflex\ testing \quad (1)$$
$$= 0.25$$

We assume the percent change in the proportion of patients lost following steps 1 and 2 in Table 1 will be the same across Baseline and Reflex. Since this value is known for Baseline, we can apply it to Reflex. The percent change in proportion lost for the RNA and specialist states from Baseline is given by:

$$\%\Delta Lost^i_{RNA,Spec} = \frac{P(X_{t+1} = Lost|X_t = Specialist\ Visit)^i - P(X_{t+1} = Lost|X_t = RNA\ Test)^i}{P(X_{t+1} = Lost|X_t = RNA\ Test)^i} * 100 \quad (2)$$

where $P(X_{t+1} = Lost|X_t = RNA\ Test)^i$ and $P(X_{t+1} = Lost|X_t = Specialist\ Visit)^i$ are from the literature.

The proportion lost following genotype/fibrosis testing (ie, step 2 in Table 1) in Reflex reflects the proportion lost following Ab-RNA reflex (step 1), 25%, and the percent change in proportion of patients lost following steps 1 and 2 as calculated from Baseline:

$$P(X_{t+1} = Lost|X_t = Genotype)^i$$
$$= proportion\ lost\ after\ genotype/fibrosis\ staging\ for\ site/insurer\ i$$
$$= 0.25 * (1 - \%\Delta \mathrm{Lost}^{\mathrm{i}}_{\mathrm{RNA,Spec}}) \quad (3)$$

3.1.2.1.2. Consolidated scenario: proportion lost after "Visit 1"

For Consolidated, we assume the proportion lost following "Visit 1" should be less than the proportion lost after the genotype/fibrosis test in Reflex since patients have only had one visit in Consolidated after genotype/fibrosis testing compared to two in Reflex.

To construct the lost parameter associated with "Visit 1", we assume the unadjusted proportion lost after "Visit 1" will equal the proportion lost after genotype/fibrosis testing in Reflex ($P(X_{t+1} = Lost|X_t = Genotype)^i$). We then adjust the baseline proportion lost downward by the percent change in proportion of patients lost following steps 1 and 2 as calculated from Baseline:

$$P(X_{t+1} = Lost|X_t = Visit1)^i = P(X_{t+1} = Lost|X_t = Genotype)^i * (1 - \%\Delta Lost^i_{RNA,Spec}) \quad (4)$$

where *i* indexes insurance type.

All transition parameters after the treatment recommendation are the same across the three scenarios. Transition parameters are provided in Table 2 below.

Table 2. Transition Parameters (%)

	Medicaid	Medicare	Commercial
Disease Prevalence			
Proportion Ab Positive	16.0% [7]	9.0% [8]	5.0%[b] [8]
Proportion RNA Positive	79.7%[a] [4]	79.7%[a] [4]	79.7%[a] [4]
Treatment Decision			
Treatment prescribed	54.8%[a] [9]	54.8%[a] [9]	54.8%[a] [9]
No Treatment prescribed	25.2%[d]	25.2%[d]	25.2%[d]
Drug Testing and Prior Authorization			
Probability of drug testing	99.0%[d]	0.0%	0.0%
Probability of pass drug test	71.0%[a] [10]	N/A	N/A
Probability of PA approved[e]	51.1%	81.0%	40.0%
Probability of PA denied[e]	45.9%	13.2%	55.4%
Lost to Follow Up (*Baseline*)			
Lost after Ab Testing	21.2%[b] [4]	21.2%[b] [4]	21.2%[b] [4]
Lost after RNA Testing	83.0%[f] [11]	72.7%[b] [9]	72.7%[b] [9]
Lost after Specialist	20.0%[d] [6]	20.0%[d] [6]	20.0%[d] [6]
Lost after treatment prescribed	1.0%[b] [12]	1.0%[b] [12]	1.0%[b] [12]
Lost after PA[e]	3.0%	5.8%	4.6%

Lost to Follow Up (*Reflex*)			
Lost after Genotyping and Fibrosis Test[g]	6.0%	6.9%	6.9%
Lost to Follow Up (*Consolidated*)			
Lost after Ab, RNA, Genotype, and Fibrosis Test[g]	1.5%	1.9%	1.9%
Treatment Recommendation and Optional Specialist Parameters (*Reflex*)			
Treatment prescribed by PCP[h]	19.1%	20.0%	7.2%
No Treatment prescribed by PCP[h]	15.8%	16.5%	22.8%
Optional specialist visit[h]	52.4%	54.7%	45.0%
Treatment Recommendation and Optional Specialist Parameters (*Consolidated*)			
Treatment prescribed by PCP[h]	20.5%	21.2%	9.6%
No Treatment prescribed by PCP[h]	16.9%	17.5%	30.4%
Optional specialist visit[h]	56.1%	58.1%	60.0%

Notes: We assume prevalence is the same for Baseline, Reflex, and Consolidated.

[a] Insurance-specific parameter not available; general parameter used.

[b] Commercial-specific parameter used, but was taken from PCP setting

[c] Uninsured-specific parameter used, but was taken from ED setting

[d] Calculated

[e] Gilead PA adjudication data

[f] Medicaid parameters derived from a source focused on emergency room patients

[g] Parameters derived from Baseline model. The proportion of patients lost after the (optional) specialist visit is assumed to be 0.01 in both Reflex and Consolidated Models. Once treatment is prescribed, the states and transitions for the Reflex and Consolidated Models are the same as the Baseline Model.

[h] The proportion of patients who visit a specialist and are not prescribed treatment is 0.06[13]. We assume the proportion of patients lost after seeing a specialist is 0.01, and therefore the proportion of patients who receive prescriptions is 0.93 so that the transitions sum to 1.

3.2. Timing parameters

A model with more narrowly defined states would have required more nuanced parameters. Given that we were unable to populate all model transitions without relying on assumptions to

fill in gaps in the literature, it is unlikely we would have been able to populate a more nuanced version of the model for many of the insurance types. Rather than model these intermediate steps explicitly, we implicitly capture them by incorporating wait times (implemented using transitions of the form P(X(t+1)==A|X(t)==A) > 0 for each state A that has a wait time longer than one cycle) for each screening state.

Few timing parameters were available in the literature. Time for prior authorization was calculated using adjudication data provided by Gilead. We relied on various assumptions about timing to fill in gaps. The following table shows the Baseline timing parameters for each insurance type selected based on literature and assumption.

Table 3. Baseline Timing Parameters

	Medicaid	Medicare	Commercial
Ab test to RNA test	51 days[9]	51 days[9]	51 days[9]
RNA test to Specialist Visit[a]	2.5 months	2.5 months	2.5 months
Specialist Visit to Treatment Recommendation[b]	0 days	0 days	0 days
Treatment Recommendation to Drug and Alcohol Testing[b]	0 days	N/A	N/A
Time between Failed Drug and Alcohol Test and Subsequent Test	4.5 months	N/A	N/A
Prior Authorization request to prior authorization decision[c]	8.5 days	20.2 days	19.4 days

[a] Assumed to have PCP; Assumed 2.5 months for specialist referral. These assumptions are consistent with published estimates for time between RNA testing and specialist visit for the VA population (9 weeks)[14]

[b]Specialist visit, treatment recommendation, and drug and alcohol testing (if required) are assumed to take place during the same visit. For patients who receive a 'clean' result for their drug test, we assume they move to the prior authorization step immediately.

[c] Based on adjudication data provided by Gilead

3.3. Cost parameters

Costs were assigned to each state in the screening process based on the test conducted in that state. Costs were obtained using the CMS Physician Fee and Laboratory Fee schedules.[15,16] The specific testing procedure was identified by the appropriate *Current Procedural Terminology (*CPT) or Healthcare Common Procedure Coding System (HCPCS) code to distinguish these tests from related tests, given in Table 4.

Table 4. Model Costs and Sources

Cost	CPT Code	Model Parameter
HCV antibody test	86803	$19.44
Quantitative HCV RNA test	87521 (amplified probe technique)	$47.80
Genotype test	87902	$350.69
Non-invasive liver fibrosis staging	76700	$124.69
Specialist Visit	99204	$166.73
Alcohol and/or drug screening with brief intervention, Medicaid	H0050 (HCPCS code)	$48

As the model ends with treatment initiation, treatment costs were not included in the analysis. We assumed there was no direct cost associated with PA. Since we assume a patient perspective for cost, we do not incorporate the overhead cost associated with screening site operation or other health system costs.

3.4. Model outcomes

The following key outcomes were measured in the model: yield, yield conditional on HCV infection, number lost to follow-up, and costs. Yield was defined as the percentage of patients entering the model for HCV antibody screening who complete the process and initiate treatment. Conditional yield was defined as the percentage of patients who are either Ab+ or chronically infected with HCV who complete the process and initiate treatment. The number of patients lost to follow-up is calculated after each stage and for the entire process. We also calculated total cost

(which includes screening cost and treatment cost), total cost of screening, total cost of screening per person treated, and total cost of screening per person screened.

4. Additional Results

4.1. Yields

Table 5 presents the same yield results from the main manuscript, and additionally presents yield conditional on Ab+ status. The key difference between a chronically infected patient and a patient who is Ab+ but not chronically infected is that the chronically infected patient requires treatment, but an Ab+ patient who is not chronically infected only needs a confirmatory RNA test to successfully complete the SLTC process.

Table 5. Yield and conditional yield results

		Medicaid	Medicare	Commercial
Yield	Baseline	0.5%	0.7%	0.2%
	Reflex	3.5%	3.1%	0.9%
	Consolidated	4.9%	4.4%	1.2%
Conditional yield (Ab+ patients)	Baseline	2.9%	7.5%	3.7%
	Reflex	22.1%	34.6%	17.1%
	Consolidated	30.9%	48.6%	24.0%
Conditional yield (RNA+ patients)	Baseline	3.7%	9.5%	4.8%
	Reflex	27.7%	43.5%	21.6%
	Consolidated	38.7%	61.1%	30.2%

4.2. Costs

Table 6. Screening costs for a cohort of 10,000 patients entering the screening process

		Medicaid	Medicare	Commercial
Total screening cost (total patients treated)	Baseline	$368,598 (47)	$328,648 (68)	$269,337 (19)
	Reflex	$819,606 (354)	$523,952 (312)	$377,585 (86)
	Consolidated	$1,012,774 (494)	$628,475 (438)	$436,164 (120)
Cost of screening, per-person treated	Baseline	$7,843	$4,833	$14,176
	Reflex	$2,324	$1,680	$4,430
	Consolidated	$2,049	$1,446	$3,615
Cost of screening, per-person screened	Baseline	$37	$33	$27
	Reflex	$82	$52	$38
	Consolidated	$101	$63	$44
Cost to identify one additional	Baseline	$1,586	$1,539	$2,546
	Reflex	$283	$441	$730

chronically infected patient and link to care	Consolidated	$212	$331	$548

Notes: All costs are in 2016 USD. Total screening cost includes the cost of diagnostic tests, the cost of a specialist visit (when applicable), and the cost of drug testing (Medicaid population only). Diagnostic tests include: antibody testing, RNA testing, non-invasive fibrosis staging, and genotype testing.

4.3. Timing Results

Table 7 presents total treated, yield, and yield conditional on RNA+ for three-, six-, and twelve-month time horizons. These results provide insight into how quickly patients are able to complete the SLTC process. Note that most patients are have completed the process within the first year; therefore, the 12-month results are similar to the full lifetime horizon results presented in the manuscript.

Table 7. Timing results: 3-month, 6-month, and 12-month horizons

		Number Treated (% of Total Ultimately Treated)			Yield (Yield, Conditional on RNA+)		
		3 months	6 months	12 months	3 months	6 months	12 months
Commercial	Baseline	5 (29%)	14 (75%)	18 (98%)	0.1% (1%)	0.1% (3%)	0.2% (5%)
	Reflex	56 (66%)	77 (90%)	85 (99%)	0.6% (14%)	0.8% (19%)	0.8% (21%)
	Consolidated	83 (98%)	110 (99%)	119 (99%)	0.8% (21%)	1.1% (28%)	1.2% (30%)
Medicaid	Baseline	10 (22%)	34 (72%)	46 (98%)	0.1% (1%)	0.3% (3%)	0.5% (4%)
	Reflex	212 (60%)	314 (89%)	350 (99%)	2.1% (17%)	3.1% (25%)	3.5% (27%)
	Consolidated	217 (64%)	444 (90%)	490 (99%)	3.2% (25%)	4.4% (35%)	4.9% (38%)
Medicare	Baseline	19 (29%)	205 (66%)	303 (69%)	0.2% (3%)	0.5% (7%)	0.7% (9%)
	Reflex	51 (75%)	282 (90%)	400 (91%)	2.1% (29%)	2.8% (39%)	3.1% (43%)
	Consolidated	66 (98%)	310 (99%)	435 (99%)	3.0% (42%)	4.0% (56%)	4.4% (61%)

5. Alternative analyses and results

We estimated three alternative scenarios for each model: 1) Fixed Ab prevalence: to evaluate the effect of prevalence on model outcomes, we used a fixed prevalence across all insurers; 2) No Genotype Testing: assumed the genotype test was not required as part of the screening process (ie to estimate results if a pan-genotypic treatment is available); 3) No Sobriety Requirements: assumed Medicaid patients did not face sobriety requirements.

5.1. Fixed Ab prevalence

The fixed Ab prevalence analysis allows us to compare the efficiency of the SLTC process across insurance types net of differences in prevalence. Table 8 shows the difference in prevalence (ie, the proportion of patients who are Ab+) across the main analysis and this alternative analysis. The prevalence estimate for the fixed Ab analysis was derived using the average of prevalence across multiple sources that incorporated patients with various insurance types who were screened at different sites.[7,11,14,17-22]

Table 8. Proportion Ab+, by analysis and insurance type

	Medicaid	Medicare	Commercial
Main analysis	0.160	0.090	0.050
Fixed Ab prevalence	0.128		

Table 9. Fixed Ab Prevalence: Lost to follow-Up and yield results for a cohort of 10,000 patients entering the screening process

		Medicaid	**Medicare**	**Commercial**
Number of patients lost to follow-up (% of Ab positive)	Baseline	969	908	906
	Reflex	329	354	348
	Consolidated	46	78	69
Yield	Baseline	0.4%	1.0%	0.5%
	Reflex	2.8%	4.5%	2.2%
	Consolidated	3.9%	6.2%	3.1%
Conditional yield (Ab+ patients)	Baseline	2.7%	7.5%	3.7%
	Reflex	20.1%	34.6%	17.1%
	Consolidated	27.9%	48.3%	23.9%
Conditional yield (RNA+ patients)	Baseline	4%	9%	5%
	Reflex	28%	43%	21%
	Consolidated	38%	60%	30%
Required # of patients screened	Baseline	25	20	20

to get 1 additional HCV patient into treatment	Reflex	13	13	13
	Consolidated	10	10	10

Table 10. Fixed Ab Prevalence: Cost results for a cohort of 10,000 patients entering the screening process

		Medicaid	**Medicare**	**Commercial**
Total screening cost (total patients treated)	Baseline	$334,217 (38)	$383,338 (96)	$383,177 (47)
	Reflex	$696,751 (280)	$666,083 (446)	$667,503 (220)
	Consolidated	$838,441 (389)	$812,488 (623)	$808,152 (308)
Cost of screening, per-person treated	Baseline	$8,795	$3,993	$8,153
	Reflex	$2,488	$1,493	$3,034
	Consolidated	$2,155	$1,304	$2,624
Cost of screening, per-person screened	Baseline	$33	$38	$38
	Reflex	$70	$67	$67
	Consolidated	$84	$81	$81
Cost to identify one additional chronically infected patient and link to care	Baseline	$646	$521	$521
	Reflex	$336	$332	$332
	Consolidated	$256	$251	$251

5.2. Removal of genotype testing

With the recent availability of a pan-genotypic treatment, the genotype testing stage might eventually become unnecessary for patients. To evaluate the effect of the genotype testing stage on model outcomes, we removed this requirement for all insurers. Since genotype testing occurs during the same visit as non-invasive fibrosis staging, removing genotype testing only impacts costs in our model. Table 11 shows the costs associated with screening a cohort of 10,000 patients, with and without a required genotype test.

Table 11. No Genotype Testing: Screening costs for a cohort of 10,000 patients entering the screening process

		Medicaid	**Medicare**	**Commercial**
Main Analysis				
	Baseline	$368,598 (47)	$328,648 (68)	$269,337 (19)
	Reflex	$819,606 (354)	$523,952 (312)	$377,585 (86)

Total screening cost (total patients treated)	Consolidated	$1,012,774 (494)	$628,475 (438)	$436,164 (120)
Cost of screening, per-person treated	Baseline	$7,843	$4,833	$14,176
	Reflex	$2,324	$1,680	$4,430
	Consolidated	$2,059	$1,446	$3,615
Removal of Genotype Testing				
Total screening cost (total patients treated)	Baseline	$ 308,312 (47)	$ 273,499 (68)	$ 238,296 (19)
	Reflex	$ 552,851 (354)	$ 378,257 (213)	$ 295,064 (86)
	Consolidated	$ 660,613 (494)	$ 428,435 (438)	$ 324,741 (120)
Cost of screening, per-person treated	Baseline	$ 6,510	$ 4,033	$ 12,809
	Reflex	$ 1,564	$ 1,211	$ 3,445
	Consolidated	$ 1,336	$ 978	$ 2,701

5.3. Removal of sobriety requirements

Finally, we removed the sobriety requirement for the Medicaid group. Since we assume patients who reach the sobriety requirement state in the model cannot be lost between the sobriety requirement and prior authorization, yields do not change relative to the main analysis. Removing sobriety requirements impacts the cost of screening, which is presented in Table 12. Specifically, we find that removing sobriety requirements reduces total costs by 1% in Baseline and 4.5% in Reflex and Consolidated. Comparing total costs across the main results and no sobriety requirements analysis, the overall effect of removing sobriety requirements in a cohort of 10,000 patients may make it seem that sobriety requirements have a relatively small impact. However, if we apply the cost-savings to a cohort equal to the total estimated number of adults enrolled in Medicaid in January 2017 for states with sobriety requirements (approx. 23.4 million), removing sobriety requirements in all these states would save Medicaid $9.2 million in Baseline, $86.0 million in Reflex, and $106.7 million in Consolidated.

Table 12. No Sobriety Requirements: Screening Costs Associated with Removal of Sobriety Requirements for the Medicaid Population

		Medicaid
Main Analysis		
Total screening cost (total patients treated)	Baseline	$368,598 (47)
	Reflex	$819,606 (354)
	Consolidated	$1,012,774 (494)
	Baseline	$7,843

Cost of screening, per-person treated	Reflex	$2,324
	Consolidated	$2,059
No Sobriety Requirements		
Total screening cost (total patients treated)	Baseline	$ 364,656 (47)
	Reflex	$ 782,803 (354)
	Consolidated	$ 967,144 (494)
Cost of screening, per-person treated	Baseline	$ 7,759
	Reflex	$ 2,211
	Consolidated	$ 1,958

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