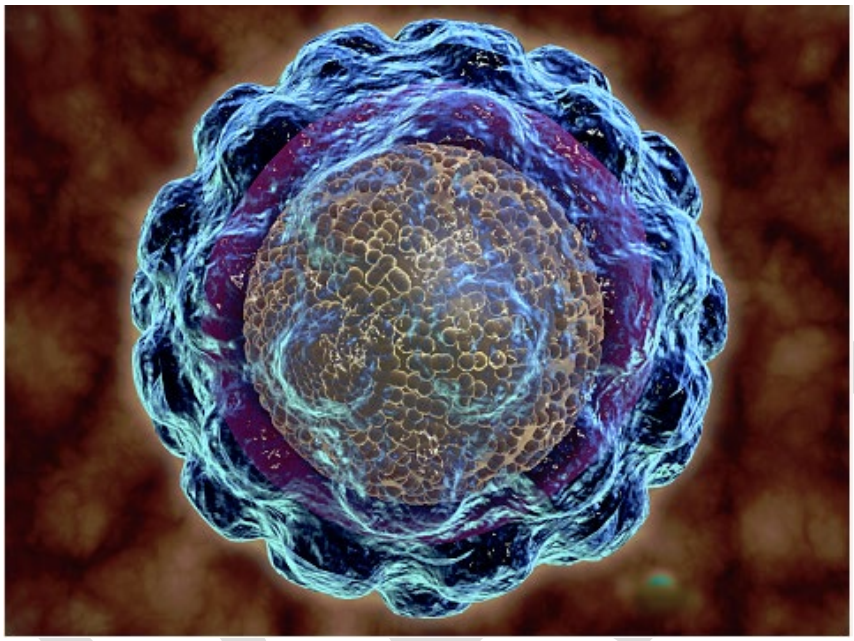
Identifying high-priority diagnostic approaches for advancing hepatitis C elimination in the US

Meeting Summary Report (Draft)



October 19-20, 2021
Virtual Meeting

APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES

Table of Contents

Abbreviations

Ab	Antibody
Ag	Antigen
APHL	Association of Public Health Laboratories
cAg	Core antigen
CDC	US Centers for Disease Control and Prevention
CLIA	Clinical Laboratory Improvement Amendments
CMS	Center for Medicaid and Medicare Services
EHR	Electronic health record
FDA	US Food and Drug Administration
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
POC	Point of care
PWID	Persons who inject drugs
QC	Quality control
STD	Sexually transmitted disease
SME	Subject matter expert
SVR	Sustained virologic response

Nomenclature:

FDA Approved/Approval: We have used the term FDA approval in the general sense in this document to indicate either FDA approval to indicate that a device has been approved through the premarket approval process (PMA) which is required for a Class III device or FDA clearance to indicate a device that has been cleared as a substantially equivalent device through Section 510(k) of the Food, Drug and Cosmetic Act which is required for Class II devices or through other FDA review processes such as the *De Novo* process.

Capillary Blood: We have used the term capillary blood to indicate whole blood collected by a fingerstick or heel stick. The blood can then be collected into a variety of different collection devices/tubes/microtainers.

Executive Summary

Hepatitis C virus (HCV) infection is the most common bloodborne infection in the United States with more than 2.4 million persons living with HCV and approximately 40% are unaware of their infection status. Without knowing their status, they cannot benefit from curative treatment which could prevent disease progression, hepatocellular carcinoma and disease transmission—"a preventable strategy and a public health travesty."[1]

National hepatitis C elimination targets have been established in the United States, yet at current incidence and treatment rates, the US is projected to reach these targets after 2050. The Centers for Disease Control and Prevention's (CDC) Division of Viral Hepatitis (DVH) published their 2025 Strategic Plan outlining their goals which were aligned with global goals to eliminate viral hepatitis as a public health threat by 2030. Specifically, 2030 goals are to reduce new HCV infections by 90% and to reduce hepatitis B and hepatitis C related deaths by 65%.[2–4] These goals are ambitious and require unfettered access to viral diagnostic, prevention and treatment services among the appropriate populations as well as coordination amongst a multitude of stakeholders. Specific HCV-related goals include:

- reduce new HCV infections from 44,700 in 2017
  - to ≤ 35,000 in 2023 and ≤ 4,400 in 2028
- reduce rate* of HCV related mortality from 4.13 in 2017
  - to ≤ 3 in 2023 and ≤ 1.44 in 2028
- reduce HCV-related disparities:
  - reduce rate* of new HCV infections among PWID from 2.3 in 2017
    - to ≤ 1.7 in 2023 and ≤ 3.58 in 2028
  - reduce rate* of HCV-related deaths among American Indian and Alaska Native persons from 10.24 in 2017
    - to ≤ 7.15 in 2023 and ≤ 3.58 in 2028
  - reduce rate* of HCV-related deaths among non-Hispanic Black persons from 7.03 in 2017
    - to ≤ 4.92 in 2023 and ≤ 2.46 in 2028
- establish comprehensive national viral hepatitis surveillance for public health action.

*Rates are per 100,000 population

HCV infection can be cured; diagnostic testing is the first step. The United States currently recommends a two-step HCV testing strategy: antibody detection followed by a viral detection test among those with detectable antibody levels. Based on data from several sources high proportions of people initially identified as having antibodies to HCV do not receive subsequent viral detection testing, are not linked to care, and are not treated to cure chronic infection. With this as the backdrop, DVH partnered with the Association of Public Health Laboratories (APHL) to convene a two-day consultation of HCV SMEs on October 19-20, 2021, to identify high priority diagnostic tools that will have the greatest impact on advancing the elimination of HCV in the US within the next five years. The proceedings were guided by key questions whose answers and implications are documented in this meeting report.

Overall Recommendations for Action

This section is grouped into three sections: Foundational Changes Required, Diagnostic Tools or Approaches Needed and Additional Considerations. The recommendations listed in "Foundational Changes Required" are cross-cutting issues that must be addressed to improve any other efforts identified in the Diagnostic Tools or Approaches. Square brackets are used to identify groups or agencies that the recommendation is targeted at throughout this section.

Foundational Changes Required

1. Reclassification of HCV Antibody and Nucleic Acid tests from Class III Devices (PMA) to Class II Devices with special controls (510k) to decrease barriers to modifying currently approved methods and to bringing new methods to the US Food and Drug Administration (FDA) for review. [FDA]

   On November 19, 2021 the FDA issued the final order re-classifying certain HCV Diagnostic Tests from Class III to Class II. [5,6]

2. Assess reimbursement challenges for HCV diagnostic testing [Center for Medicaid and Medicare Services (CMS)]
   a. Federal Policy and Reducing Barriers
   b. Challenges were raised regarding both rates of reimbursement and ability to charge for testing under various scenarios (i.e., who and where testing is performed, frequency/interval of testing, reasons for testing, types of tests performed (bundled tests).
   c. CMS to reissue letter/guidance on opt-out testing to reduce restrictions as not all entities have acknowledged this.

3. Review and Update Guidance for Diagnostic Testing for HCV [CDC]
   a. Consideration for creating algorithms that fit the population or setting where persons are seeking care/testing is being ordered or performed.

      Consideration for maintaining one-time screening of all adults with HCV Ab (with automatic reflex to HCV RNA as needed) for persons seeking care in healthcare settings and updated algorithms focused on virologic detection (Bullet b below) for risk-based/high prevalence settings.
      i. Consideration will need to be made for tolerance for different levels of sensitivity/specificity for a test and/or setting.
      ii. Examine other situations such as HIV testing algorithms which have been adapted to meet needs of different populations and settings (laboratory based, non-clinical etc.).
      iii. Need to explore the role for self-collection and self-testing and how it may address unmet needs and gaps in testing.
   b. Consideration for single step testing algorithm with detection of HCV viremia only or HCV RNA as the first step.

i. Examples of settings where this algorithm might be most appropriate include corrections, emergency departments, harm reduction/substance abuse treatment settings, FQHCs, other community-based testing sites, mobile and outreach settings.
ii. CDC would need to work with HCV surveillance programs to review impact on surveillance methods and ability to assess movement towards elimination-locally and nationally.
iii. CDC and other organizations would need to evaluate and recommend testing algorithm with consideration for populations where this would make the most sense for diagnosis and being mindful of cost-effectiveness and reimbursement.
iv. Diagnostic manufacturers and FDA would need to identify data needs to update FDA approved assays to include an intended use claim to use HCV RNA methods (or potentially HCV cAg down the road) in the absence of HCV Ab results for detection of current HCV infection.

c. Consider eliminating HCV antibody (Ab) only testing wherever feasible; causes confusion for patients and stigma, delay in appropriate diagnosis.
i. This change would necessitate regulation to require reflexing to HCV RNA following a reactive HCV Ab result or a stand-alone virologic testing algorithm.

d. Identify role of HCV core antigen (cAg) in diagnosis of current infection, treatment initiation and sustained virologic response (SVR).

4. Clear Messaging and Reporting of HCV Diagnostic Testing and Results [Diagnostic Manufacturers, FDA, Laboratories, Partner Organizations]
a. Will continue to be important as barriers are dropped and testing/treatment is moved to non-specialists to ensure proper testing is ordered and results are used appropriately prior to initiation, for monitoring and for confirmation of SVR.
b. If there are changes to testing recommendations/algorithms patient and provider education and clear reporting will continue to be essential to proper interpretation and implementation of test results.

Diagnostic Tools/Approaches Needed

1. Development and FDA approval of rapid (<30 minutes from sample collection to result), Clinical Laboratory Improvement Amendments (CLIA)-waived point-of-care (POC) HCV RNA test. [Diagnostic Manufacturers, FDA].
a. Diagnostic Manufacturers with commercially available tests (outside the US) should take necessary steps to bring test to market (FDA approval) and/or develop HCV diagnostic test to fit this goal.
b. Confirmatory testing may still be required depending on recommended testing algorithms, population being tested as well as the sensitivity, specificity and positive predictive value of the method.
c. Considerations for development and implementation should include:
i. test performance (e.g., sensitivity, specificity, positive predictive value, negative predictive value, etc.)

ii. test cost and reimbursement rate(s)
iii. indication for use should include diagnosis and treatment monitoring (i.e., to ensure ability to use result for rapid treatment initiation and SVR)
iv. ensuring test results are reported to public health authorities and connected with health information systems

d. Coordination of stakeholders to ensure rapid and widespread implementation includes coordination between diagnostic manufacturer and FDA along with partners recommending testing algorithms [CDC, AALSD, USPSTF] and ensuring appropriate mechanisms for reimbursement [CMS].

2. Development and FDA approval of a rapid (<30 minutes from sample collection to result), CLIA-waived point-of-care HCV cAg or HCV Ag/Ab (with ability to differentiate Ag/Ab) to identify current infection. [Diagnostic Manufacturers, FDA].
    a. Same considerations as #1 above
3. Improvements to Laboratory-Based Testing Methods
    a. Increase laboratory implementation of auto-reflexing HCV Ab positive samples directly to HCV RNA testing. [CDC, Laboratories, Public Health Agencies, State/Local Governments, Partner Organizations]
        i. Ensure best practices are also shared so laboratories aren't requiring unnecessary additional vials of blood to complete testing.
    b. Create different kit sizes and extended storage time for test reagents, controls and calibrators enabling smaller volume laboratories to use high throughput/random access instruments more cost effectively. [Diagnostic Manufacturers, FDA].
    c. Seek and obtain updated indications for use on already FDA approved test methods (HCV Ab and HCV RNA) for additional specimen types such as dried blood spot (DBS), capillary blood and plasma separation cards. [Diagnostic Manufacturers, FDA].
    d. Obtain updated intended use claim on previously FDA approved HCV RNA methods to be used as first or only test for diagnosis of current HCV infection (remove requirement for HCV Ab result) so that they could be used for screening or diagnosis of current HCV infection. [Diagnostic Manufacturers, FDA].
4. Additional Tools for Rapid Treatment Initiation
    a. Development and FDA approval of a rapid (<30 minutes from sample collection to result), CLIA-waived POC hepatitis B virus surface antigen (HBsAg) test. [Diagnostic Manufacturers, FDA].
    b. Development and FDA approval of laboratory based, and or CLIA-waived POC multiplex for HCV, HIV and HBV NAT test. [Diagnostic Manufacturers, FDA].

Additional Considerations

These are broad additional considerations that were raised during the meeting and either fit in more than one place in the document or were not specific to any one key question.

1. Broad and reinforced endorsement of Opt-Out Testing for HCV due to issues with entities still requiring consent prior to testing (e.g., Veteran's Affairs Administration). [CDC]

2. Further assess barriers to bringing tests to market in the US including those approved for use outside the US [CDC, APHL, FDA, Stakeholders]
3. Consider mechanisms to ensure samples are available to manufacturers to conduct needed evaluations and data collection. [CDC, APHL, FDA, Stakeholders]
    a. This will be especially important for alternative specimen types such as capillary blood or DBS or access to paired specimens to establish clinical performance.
4. Further assess current HCV care cascade to determine if there are other aspects that can be addressed and determine what innovations are needed to address populations that aren't accessing care to meet HCV elimination goals and to further reduce access to treatment.
5. Develop testing algorithms or recommendations for perinatally exposed infants similar to those developed for detection of HIV in this population.
    a. Testing for this population poses additional complications that must be addressed for a comprehensive HCV elimination strategy and will require FDA-approval of non-venipuncture specimens such as capillary blood and/or smaller volume collections.
6. Suggestion to consider possibility of HHS declaration of a public health emergency for HCV infection thereby opening the door for EUA for HCV diagnostics needed to combat it.
    a. This would be a temporary solution and any diagnostic tools approved under an EUA would need to still be cleared through the 510K process to be used once the emergency ended.

Process Summary

Background

Beginning in June 2021, APHL began planning the meeting in collaboration with CDC's Division of Viral Hepatitis to convene key subject matter experts (SMEs) to discuss the high-priority diagnostic approaches needed for advancing hepatitis C elimination in the US over the next five years. APHL and CDC worked together to define the key questions (Appendix A). For each key question a panel of SMEs were chosen to present and discuss the topic. The panel included representation from different perspectives including a clinical provider, a clinical laboratory scientist and a representative from a state or local public health agency.

Meeting

Invited participants represented SMEs and stakeholders from a variety of settings to ensure comprehensive discussion and input. Participants included representatives from public health laboratories, clinical laboratories, large commercial laboratories, clinical providers, academic researchers, public health agencies, diagnostic manufacturers, staff from the CDC including: Office of the Director within the National Center for HIV, Viral Hepatitis, STD, and Tuberculosis Prevention (NCHHSTP), and Division of Viral Hepatitis (DVH), Centers for Medicaid Services (CMS), Food and Drug Administration (FDA), Foundation for Innovative New Diagnostics (FIND), Health and Human Services, Office of the Assistant Secretary for Health (OASH), Office of Infectious Disease and HIV/AIDS Policy (OIDP), National Institute of Allergy and Infectious Diseases (NIAID), World Health

Organization and other partner public health organizations. For a complete list of participants see Appendix B, and their financial disclosures, Appendix D.

The goal of the meeting was for all invited participants to listen to each panel present their input and perspective on their assigned key question. Participants were also expected to provide feedback on all the key questions to generate high priority needs and recommendations for each key question. To ensure each key question was evaluated appropriately each panel had 75 minutes total including a 15 minute presentation, 9 minutes for input from 3 panelists, up to 10 minutes for invited comments from FDA, CMS and/or Diagnostic companies, followed by 30-40 minutes for a facilitated discussion and input from all the participants (Agenda; Appendix C). The presentation was focused on the background and information necessary for consideration of the key question as well as the expert opinion of the presenter. Panelists were asked to provide their expertise on the key question from their role within the system. Moderators were asked to facilitate the discussion with three ideas in mind: 1) identifying and prioritizing diagnostic needs, 2) identifying and prioritizing research questions/data needs and 3) identifying and prioritizing the barriers that must be addressed to achieve the outlined goals. Additionally, participants were able to use the chat feature at any point during the meeting. During the second day, the panelists each had five minutes to give updated/summarized priorities and another five minutes to get feedback from the participants. At the end of the meeting a list of overall recommendations was identified.

Report

This document summarizes the overall recommendations and then the major discussion points by key question; representing input from all participants including those that presented slides or perspectives during the panels. For each key question that was discussed, background information is provided followed by the collective recommendations, any identified research/diagnostic development needs to fully address the question and barriers. The recommendations contained within this document represent those of the speakers, panelists and attendees at the meeting. Recommendations contained within this document do not represent recommendations from the Centers for Disease Control and Prevention.

This current version is a draft summary report and APHL will seek public comment for six weeks to ensure that everyone that attended the meeting, and the broader community has an opportunity to provide any additional comments before the meeting report is finalized. All submitted comments will be reviewed. Comments relevant to the accuracy of the summary meeting report will be addressed by APHL and incorporated into the final meeting report as needed. Comments about findings in the report will be collected and shared with our partners at the CDC.

Meeting Summary

Opening Session

As the opening session did not have any discussion or formal question and answer we have provided here a summary from each of the four invited speakers.

The Role of Diagnostics in Advancing Hepatis C In the US, Carolyn Wester

The rate of reported acute hepatitis C cases increased 333% during 2010-2019 (1.3 cases per 100,000 in 2019) with rates highest among 20–39-year-olds (2.9 cases per 100,000). There are also an estimated 2.4 million Americans living with hepatitis C but only about 60% of people with hepatitis C are aware of their status. The US 2025 goals for hepatitis c are to reduce new infections by ≥ 20% and to reduce related deaths by ≥ 25%. In 2020, CDC updated their HCV screening recommendations to include testing for all adults (at least once), every pregnant woman (every pregnancy) and everyone with risk factors (regularly).[7] Despite the new recommendations there are challenges to increasing HCV testing in the US including the fact that the populations affected by the recommendations (Table 1) and the service delivery settings vary widely. Additionally diagnosis of HCV requires a two-step testing algorithm which poses two challenges: the first is a missed opportunity to detect early HCV infection and the second is that it is one of several known bottlenecks in the "HCV Cure Cascade."[8]

Table 1: Populations affected by recommendations vary widely[9]

Population	Estimated Population Size	Estimated HCV Positivity
Adults (≥ 18 years old)	255,000,000 (2019)	1.7%
Pregnant Persons	3,790,000 births (2018)	3.8 per 1,000 live births
Persons who Inject Drugs	6,612,488 (2011)	54.2%

Dr. Wester also laid out some priorities for advancing HCV diagnostics in the US and highlighted some potential algorithms. Amongst the priorities she identified the need to increase access to accurate, simple, rapid, affordable testing that detects current infection and ideally in a single-step algorithm. Testing should be available in clinical settings as well as outreach and home settings and that specimens could include venipuncture blood, capillary blood, DBS and oral fluid.

Down-classification of Hepatitis C Virus Diagnostics, Maria "Ines" Garcia

The FDA follows a risk-based review of in vitro diagnostics (IVD) or medical devices which includes the reagents, instruments and systems used in the diagnosis of disease or other conditions to cure, mitigate, treat and prevent disease. The FDA is assessing the balance of the benefit and the risk to the individual. Class I devices are those that have a low likelihood of harm and risk can be mitigated using general controls. Class II devices have a moderate likelihood of harm or risk but that can be mitigated using special controls which are designed for the intended use of the device. All devices with the same intended use would comply with the same special controls. Hepatitis A

virus IVDs are currently Class II, and this was the proposed Class for down-classification of HCV Devices (which was approved after the meeting). Class III devices are those where there is a high or unknown likelihood of harm from an incorrect result and/or there is significant risk. Class III devices go through a review process called PMA. Dr. Garcia outlined the differences between Class III and Class II devices (the proposed down-classification for HCV diagnostic tests and discussed the proposed special controls for HCV Antibody tests and HCV RNA assays. The goal of the HCV reclassification is to continue to ensure safe and effective tests enter the US market, maintain high performing tests and remove some potential perceived barriers to entry into the US market.

HCV Diagnostic Tools-in the Development Pipeline, Sonjelle Shilton

The focus for FIND is on quality and cost of diagnostics for the global south with a specific interest in low- and middle-income countries. In terms of ensuring high-quality testing, Dr. Shilton described the stringent regulatory authority (SRA) that was developed by WHO and other entities to guide medicine procurement but is now widely recognized by the international regulatory and procurement community which also feeds into the WHO pre-qualification process. Globally between 2018-2020 three assays were made available: Cepheid® Xpert HCV Fingerstick cartridge, GeneDrive® HCV ID Kit and DBS HCV RNA on the Abbott m2000. In 2021, the following items were either launched or planned to launch: Fujirebio's INNOTEST HCV Ab DBS, OraSure Oraquick® HCV Ab self-test (oral fluid), Premier Medical Corp First Response HCV Ab Self-test (blood-based), DBS HCV RNA on Roche CAP/CTM and TrueNAT™ HCV (Molbio Dx). For 2022, two additional assays are expected HCV test on BlinkOne and the HCV Assay on SAMBA II. The WHO recently recommended that HCV self-testing should be offered to accelerate progress toward achieving global elimination goals.[10]

There are four near point of care (POC) HCV RNA assays currently available globally including the Xpert HCV VL Assay (plasma), Xpert HCV Fingerstick VL Assay (capillary blood), GeneDrive HCV ID Assay (plasma) and TrueNAT™ HCV Assay (plasma, serum, capillary blood) with high sensitivity (91-99%) and high specificity (98-100%) and time to result from 60-110 minutes. However, while there is improving technology, it is only as good as the system that it exists within. A POC or near POC test doesn't always equal patient impact and we also need to simplify the overall patient journey from testing to cure.

Using currently available technology the Country of Georgia conducted a study that showed using either a POC HCV RNA assay or ensuring that HCV RNA testing is performed using direct specimen referral to a central laboratory resulted in 99.8-100% of patients getting HCV RNA testing completed compared to a patient being referred to a collection site for blood draw to obtain the HCV RNA testing (standard of care) in which case only 91% of patients obtained HCV RNA testing.

What is Needed to Move Toward Single-step Diagnosis of Current HCV Infection? Jordan Feld

HCV diagnosis and treatment needs to be simplified. As was discussed previously, there are many bottlenecks or places to "get lost" in the process, especially if HCV isn't a priority (either to the patient of healthcare provider). A preferred approach would be immediate diagnosis (current infection) followed by same day treatment initiation, at least for key populations. However, the preferred approach would require a change from a two-step to a single step testing algorithm and there are many questions that would need to be addressed for this change. Dr. Feld reviews the following questions providing published data to address each question.

- Is there value in knowing about past HCV infection?
- Does it have to be an HCV RNA test?
- Does it have to be POC and what do we mean by that?
- What sensitivity is acceptable?
- Do we need a one size fits all solution?
- What are the cost considerations.

In summary a single test HCV diagnosis is possible, but it is critical to match the testing paradigm to the clinical situation—time to diagnosis is not always the biggest challenge or item to be addressed. HCV cAg could be useful (cheaper than HCV RNA testing) but not yet available or good enough as a standalone diagnostic, would be better as an HCV Ag/Ag differentiating test. True POC testing needs to be faster (< 5 minutes) and utilize specimens that don't require phlebotomy.

Key Question 1: What HCV diagnostic tools are needed to optimize diagnosis of current HCV infection in-moderate to high volume laboratories performing moderate or high complexity testing?

Background

Laboratories performing moderate or high complexity testing perform the majority of HCV diagnostic testing in the US currently. They can utilize large/multi-access, high-throughput instruments which can test hundreds of samples a day. They are also able to perform testing for HCV Ab, HCV RNA as well as genotyping in addition to testing needed to initiate HCV treatment and/or screening for co-morbid conditions. The tools that currently exist are highly sensitive and specific and functionally meet the needs of HCV diagnosis. However, there are still challenges that must be addressed. Since a large majority of testing is happening in these laboratories, if they do not require that submitters order testing that is sufficient for diagnosis there are missed opportunities (i.e., ability to order HCV Ab only as compared to requiring an automatic reflex for all HCV Ab reactive samples to be tested for HCV RNA) for improving HCV diagnosis. Additionally, laboratories must follow rules and regulations set forth by the FDA as well as their accrediting agency (e.g., CLIA, CAP etc.) which means that tests can only be used for their intended purpose, or the laboratory must establish the performance characteristics to use the test in ways that are not included in the FDA approval or in the case of a laboratory developed test. This means that an HCV RNA test, which is not currently approved for use in the absence of HCV Ab, should not be ordered as a stand-alone test unless the laboratory has established the performance characteristics for using the method in this way. This is

also true for specimen types that are not FDA approved such as dried blood spots, plasma separation cards or microtainers or specimen types that are self-collected (in a clinical or non-clinical setting).

New Diagnostic Approaches Needed

1. **Laboratory-Based HCV Ag/Ab Differentiation Combination Assays**
    a. The ideal assay design would include multiple targets for both HCV cAg and Ab to ensure high specificity and must differentiate between the two targets and would include the following specimen types: serum, plasma, capillary blood and DBS
    b. Guidelines and recommendations should be aligned to ensure that that the detection of HCV cAg (especially if HCV Ab negative) would be sufficient to indicate current HCV infection.
    c. Clear reporting language and interpretations are available, and education would be necessary.
2. **Testing platforms (both serology and molecular) that have lower throughput and would be more cost effective in a small to medium volume laboratory.**
3. **Integrated multianalyte serologic assays** (HCV with HIV, HBV, syphilis)

Opportunities for Improvement of Current Diagnostic Methods or Approaches

1. **Modifications to intended use of currently FDA approved HCV RNA assays to be used in the absence of HCV Ab results/positivity aka for "screening" persons**
    a. This would be important for detecting acute infections and for early infant diagnosis.
    b. Consideration for interpretation of result in the absence of antibody result
2. **Modifications to specimen types on currently FDA approved HCV Ab and HCV RNA tests to include capillary blood, DBS, plasma separation cards and/or other alternative specimen types.**

    This would allow specimens to be collected in the absence of phlebotomy or when phlebotomy is not preferred by the setting or patient or a *specimen type that is more stable for transport to a centralized/remote laboratory facility.*

    a. Develop accompanying best practices for collection of these alternative specimen types and processing them in the laboratory to maximize sample recovery.
    b. Considerations for additional measures around handling DBS given the potential for very high HCV RNA levels in persons with HCV infection and the highly sensitive methods used for detection. Laboratories must be cautious about processing these specimens. Perforated DBS cards would be helpful. Additionally, testing of DBS would likely be most appropriate for lower to medium volume laboratories due to the significant hands-on time necessary for processing the specimens (in the absence of any major change).
3. **Modifications to currently FDA approved HCV RNA assays including offering smaller kit sizes and/or extending the storage time allowable for test reagents, calibrators and controls.**

    Currently some instruments require that the calibrators/controls be used within 24 hours after opening. For a small-medium volume laboratory they may not be able to use the full volume within that time frame without batching. To optimize turnaround times and not waste resources, a smaller volume of calibrators/controls and/or a

longer storage time (increasing to 72 hours) would enable laboratories to decrease or eliminate batching.

4. **Increase Implementation of Automatic Reflexing of HCV Ab positive specimens to HCV RNA Testing (following the current recommended algorithm).**

   Based on US CAP Survey June 2021: 2,242 laboratories performing HCV Ab testing but only 452 performing HCV RNA testing (may not all be US laboratories). To decrease barriers to implementation the following items should be considered:

   a. Policy/Regulatory Items:
      i. National organizations (Federal and Non-governmental) to recommend the testing practice and provide support for implementation including methods to minimize, reduce or remove concerns about cross-contamination of samples.
      ii. CDC and others providing funding support could incentivize reflex testing by building into RFAs as essential component of funding.
      iii. Work with Accountable Care Organizations (ACO) to make automatic reflex testing a quality metric.
      iv. Work with laboratory regulatory/accreditation agencies to require reflexing as a practice. One potential option is to work with CAP to add it to the checklist, ideally as a Phase II deficiency. Phase II deficiencies must be corrected before accreditation is granted since they seriously affect the quality of patient care. Alternatively, it could start as a Phase I error which requires correction and a written response and is also used for a new checklist item.
      v. Assessing the regulatory landscape to determine who has the regulatory authority to require laboratories to perform HCV RNA testing on all HCV Ab positive specimens.
   b. Implementation Items:
      i. Create standardized laboratory workflows or best practices (to cover specimen collection, ensuring cross-contamination has been assessed ruled/out)
      ii. Laboratory to implement mechanisms to ensure that all HCV Ab positive samples receive HCV RNA testing (i.e., programming of LIMS or other alerts/reminders).
      iii. Laboratory to remove option for ordering HCV Ab only
   c. Education/Awareness:
      i. Work with laboratories to determine barriers to implementation and identify alternative methods to help address the barrier.
      ii. Ensure all stakeholders understand the purpose for the automatic reflex, ordering of the test and receiving results.

5. **Policy and Operational Considerations to support and facilitate optimal implementation of the diagnostic tools (new or current).**

Barriers to be Addressed

1. **CMS mandates that there is differential coding for screening (asymptomatic, CPT Code G0472) versus diagnosis (symptomatic).**

a. CMS reimbursement is based on USPSTF screening recommendations to determine if it benefits the Medicare beneficiaries. The coverage criteria do not specify whether testing is started with HCV Ab or HCV RNA testing.
b. CMS reimburses testing for at-risk individuals such as perinatal, infant, person with injection drug use.
c. Remove requirements for two different codes to improve test charge reimbursement

2. **HCV Testing Algorithms** would need to be updated to allow for using HCV RNA as an initial testing option, including for specific situations such as early infant diagnosis, detection of acute HCV RNA infection persons without HCV Ab or persons at high-risk that have not had an HCV Ab test performed.
3. **Remove requirements for pre-testing consent** (i.e., Veterans Affairs Administration) despite this is an opt-out testing approach for many years.
4. **Decrease cost and effort for IVD manufacturers to obtain regulatory approval for new assays or modifications to currently approved methods.**

Other Considerations

1. **Public health and institutional policies/operational decisions are also important for addressing the barriers in the HCV care cascade using already available diagnostic tools.**
   a. One health department focused the discontinuation of rapid testing (For HIV and HCV) and required testing sites to submit to the PHL. This allowed the PHL/HD to implement integrated testing (HIV, HCV and syphilis) with automatic reflexing for confirmation which has helped them achieve public health objectives including testing for multiple pathogens, timely data for surveillance along with implementation of third-party billing (Medicaid, Medicare and commercial insurance) which has resulted in generation of revenue for the laboratory.
   b. Another consideration that was addressed, though not fool proof, is implementing mechanisms in HER to facilitate appropriate testing and follow-up.
2. **Reflex to HCV genotyping may be needed in certain situations.** There are certain situations where HCV genotyping is required to initiate treatment (i.e., typically payer requirements) and/or evaluate a potential treatment failure versus re-infection. When this is the case, it is important to ensure rapid access to HCV genotyping to minimize delays in treatment initiation. Some laboratories may be able to offer a reflex to HCV genotyping as part of their test order (if HCV RNA positive) which would provide a more rapid turnaround then having to order a new test once the HCV RNA result is provided.

Key Question 2: What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in low volume settings performing moderate complexity laboratory testing or CLIA-waived testing in clinical settings?

Background

This key question spanned two "settings" a moderately complex laboratory with low volume (not likely to use high-throughput instrumentation as in Key Question 1) and a CLIA-waived setting where testing would be performed by trained, but non-laboratory staff. Testing in these settings would need to be relatively rapid with less than 30 minutes from sample collection to result to return a result within an office visit/encounter and ideally with specimen types that don't require phlebotomy. Additionally, the testing should utilize either lower throughput instrumentation or CLIA-waived testing that can diagnose current HCV infection (i.e., HCV cAg, HCV RNA). These settings could be clinical settings facilitating rapid diagnosis and/or HCV test and treat strategies such as primary care/traditional healthcare settings, medication assisted treatment and/or substance use treatment facilities and correctional facilities. However, any CLIA-waived testing that could be used in these settings would also likely be amenable to testing in non-clinical testing (see Key Question 3 for more focus on these settings) whereas a moderate complexity test would be required to be performed in a laboratory setting and might not be suitable for use in the settings described in Key Question 3).

New Diagnostic Approaches Needed

1. **CLIA-waived POC Test for Diagnosis of Current HCV Infection**
    a. Does not require venipuncture, capillary blood preferred
    b. Ideally CLIA-waived
    c. Minimal Waste
    d. Result in <20 minutes, ideally 5 minutes
    e. Cost $10-15 and affordable device (if required)
    f. Ideally if it could also be used for SVR assessment
    g. Ability to report to LIMS, EHR, public health authority etc.

2. **CLIA-waived POC HCV cAg test at a lower cost than HCV RNA testing**
    a. EASL and WHO recognize HCV cAg as an alternate to HCV RNA when HCV RNA testing is not affordable or available.
    b. Ideally would be used for diagnosis and assessment of SVR
    c. Assay would need to be accompanied by CDC/USPSTF recommendations for use, CMS reimbursement and insurance provider acceptance of use case for test as well as education for providers on role of the assay per the above guidelines/coverage policies etc.
    d. Guidelines/recommendations should be aligned to ensure that that the detection of cAg would be sufficient to indicate current HCV infection.
    e. Clear reporting language and interpretations are available, and education would be necessary.

3. **CLIA-waived POC confirmation of Current HCV Infection: HCV cAg or HCV RNA**
4. **Assess role for CLIA-waived POC HCV Ab with oral fluid/saliva claim**
    a. This test would clearly have lower sensitivity and there are mixed opinions about where this should be a priority or not.
    b. FDA noted that they would consider a lower performance bar depending on risk/benefit profile.
5. **Lower throughput testing platforms** (See KQ1)

Opportunities for Improvement of Current Diagnostic Methods or Approaches

1. **Decrease Cost/Increase Market Competition for CLIA-waived HCV Ab testing**
2. **POC HCV RNA test(s) available outside of the US**
    a. Advocate that IVD manufacturer(s) that have products outside the US bring those to the FDA for review and approval.
    b. May require partnerships to collect or address gaps in data that would be needed for submission.

Barriers to be Addressed

1. **Simplified treatment algorithms that make embedded treatment models possible if coupled with efficient testing. Testing is only one component of test and treat models and is meaningless without access to treatment.**
    a. Must decrease payer-based barriers to accessing treatment
2. **Increase number of healthcare providers that can treat HCV and ensure sufficient provider education and engagement.**
    a. May need champions to help develop expertise in routine screening and treatment. Examples given of successful approaches are Extension for Community Healthcare Outcomes or ECHO or programs designed to train and support primary care providers and substance use disorder treatment providers to screen, evaluate, treat and cure HCV.
    b. Need to address organizational issues including how members of interdisciplinary care teams can be involved in care management.
    c. Develop best practices for sustainably integrating HCV screening and treatment into primary care as well as Office Based Addiction Treatment (OBAT) and other modalities of increasing access to HCV screening and treatment.
3. **Education, Training, Financing and Quality Management along with equitable access are required to ensure not only that the test is useful but that all the other aspects of using the test and the test result are considered within a system.**
    a. Amongst others, laboratory scientists, particularly public health laboratory staff play an important role in helping to educate submitters and to train staff in CLIA-waived settings to ensure regulatory compliance and an understanding of basic QC and assurance activities that they should be performing.
4. **Cost effectiveness**
    a. There is an overall focus to minimize cost per test. However, for a single case of HCV infection, the cost of the testing is still quite low compared to the cost of treatment. If

the goal is HCV elimination may need to consider overall cost to cure for a single case.

b. Can a higher test cost be absorbed into the public health/healthcare system because it could avert the downstream costs of additional cases due to unmitigated transmission?

c. Determining how this cost sharing should and could occur and how are costs shared in a system is a significant barrier that if addressed would be a paradigm shift for many diseases.

d. Decisions about reasonable/acceptable costs for testing reagents, instrumentation and overall test cost will be required.

5. **Coordination with FDA to determine how they could incorporate high quality international data and approvals from other stringent regulatory authorities (SRAs) to expedite the FDA approval process.**
    a. Examples of other SRAs include CE, Japan MOH
    b. This must be addressed to help create a process for review/approval rather than a determination for each IVD/diagnostic manufacturer.

Other Considerations

1. Ideal tests: better, faster and cheaper than the current options. We need to decide which of these are possible and necessary.
2. Thoughts on educating and discussing with community organizers/patients etc. on any new tests to ensure better uptake and implementation. Outreach/education to introduce innovations through peer education in harm reduction/syringe service. Frustration with not being able to provide a diagnosis.
3. Ongoing dialogue between stakeholders is needed to ensure progress

Key Question 3: What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in outreach settings and self-collection/self-testing in non-clinical settings?

Background

Testing in these settings, like those in Key Question 2, would need to be relatively rapid with less than 30 minutes from sample collection to result to return a result within an office visit/encounter and ideally with specimen types that don't require phlebotomy. The testing for outreach settings would likely need to be CLIA-waived testing that can diagnose current HCV infection (i.e., HCV cAg, HCV RNA). The settings would primarily be non-clinical sties such as mobile vans, community-based organizations and outreach settings. Self-collection of specimens either in these settings above or in a home or other non-clinical setting will also be important to improve overall access to testing. These self-collected specimens could then be either mailed/dropped off for laboratory-based testing (see Key Question 1) or if the CLIA-waived test allowed for it, could be brought to a non-clinical site for testing. For self-collection, the type of testing available will depend on what test (and where) it will be performed though the same considerations will exist for ensuring a high-quality

specimen is obtained. Overall, the goal of this question was to determine what is needed to take testing to the patient (rather than the other way around) and how to be adaptable and responsive to advance HCV elimination.

New Diagnostic Approaches Needed

1. **CLIA-waived POC HCV Viral Detection Test available for wide scale use in non-clinical settings**
    a. Ideally HCV RNA, though HCV cAg is also possible.
    b. Results in 60 minutes or less, ideally less than 15-30 minutes
    c. Cost: Affordable to public health and community-based organizations; ideally less than $30/test
    d. Same or better sensitivity/specificity to FDA- approved HCV RNA methods
    e. Minimally invasive samples including capillary blood
2. **Collection of specimens without venous draw/outside of a clinical setting-including self-collection.** *Dried blood spot (DBS) is more acceptable and less invasive to patients, can be collected at the time of a positive HCV Ab test and requires less training as compared to phlebotomy to collect. It can also be done in outreach/mobile settings (doesn't require processing like venipuncture blood) and has good stability for shipment to a central laboratory. Other capillary blood collection systems have similar utility. Additionally, these specimen types would also be able to be self-collected in these non-clinical settings to allow for diagnosis of current HCV infection. There are other collection device (i.e., Tasso collection device or neotreryx MITRA devices) which collect capillary blood which could also be explored.*
3. **Need for testing for multiple pathogens at point of contact to rapidly initiate treatment** *Reluctant to initiate treatment without knowing infection status for HIV and HBV (HBV sAg) as well as cirrhosis status. Knowing HCV status alone won't be sufficient.*

Opportunities for Improvement of Current Diagnostic Methods or Approaches

1. **Decrease Cost/Increase Market Competition for CLIA-waived HCV Ab testing**
2. **Shorten time-to-result on CLIA-waived HCV Ab tests**
    a. There are CLIA-waived HIV Antibody tests with results in 2-5 minutes, need to shorten the time for HCV Ab test, ideally to ~ 5 minutes.
3. **Improve provider understanding of HCV screening, diagnosis and treatment**
4. **A study looked at time to HCV Ab positivity as a surrogate marker for HCV viremia.**
    a. Could this approach be more widely implemented?
    b. If so, there would be major challenges with convincing third-party payers to supply treatment without an HCV RNA result, which is not aligned with current recommendations for initiating HCV treatment.

Barriers to be Addressed

1. Access to providers who can prescribe treatment immediately for HCV
    a. Varies by state
    b. Primary Care, nurse practitioners (NP), PAs, PharmDs
2. Community buy-in and political will

3. Collectively determining what is acceptable for sensitivity and specificity for tests used in a CLIA waived setting.
4. To offer simplified HCV treatment (and other treatment approaches) there is a requirement for quantitative HCV RNA testing, HIV Ag/Ab and HBsAg. But if there is a change to "virologic" detection of HCV, whether that is HCV cAg or a qualitative HCV RNA result AASLD guidelines would need to be updated as well as significant provider education as previously mentioned.
    a. Could there be meaningful distinctions between items that "must be assessed" at initiation because they influence whether, when and how to treat versus "asses as possible/after initiation" because they are relevant to overall patient care but are not required to initiate treatment.
    b. There is a need to define a minimal assessment for patients who would benefit from immediate or near-immediate treatment initiation. The minimal assessment would be analogous to minimal monitoring
5. Prevention is necessary to get to Elimination-identifying Acute Infection and Partner Services
6. Funding for elimination

Other Considerations

1. Assurances that appropriate training, QC, competency and oversight of CLIA-waived POC testing.
2. Widespread delivery of rapid POC HCV RNA testing can improve individual and public health. Ameliorating the health sector's environmental effects and reducing greenhouse gas emissions can improve health and reduce costs of care. Therefore, effective waste management/disposal should be part of the action plan/goals from the start not an add-on or after thought. This must include avoiding, reducing, safely managing healthcare waste, especially at POC, given the scale of the plan.[11]
    a. Include language/requirements on environmental impact in funding related to development, for example SBIR announcements from federal agencies.
    b. Partnerships with hospitals, public health and public health laboratories might be necessary to help manage medical waste.
3. Ensuring we maintain surveillance systems with CLIA-waived POC testing solutions.
    a. There are reasonable mechanisms that could be used to allow for continued HCV surveillance with POC testing.
4. Incentivizing return visits (or testing) to complete HCV diagnosis as a short-term solution
5. Multisite-collaborative effort to better monitor and detect acute infection. We currently have hundreds of thousands of people who inject drugs up to 8 times a day, translates to 3,000 injections per year per person. 10-20% of injects involve syringe sharing and we are under ascertaining acute infection-what are the best practices to pick up the most acute infections as quickly as possible. Develop standardized protocols: HCV cAg, DBS, different interpretations of rapid Ab test, understand implementation challenges, and building a case for building linkage to care.

Key Question 4: What other tools are needed to support same-day diagnosis and treatment of current HCV infection?

Background

Treatment of newly diagnosed HCV infection is guided by AASLD/IDSA guidelines and requires diagnostic testing beyond HCV. The goal of treatment is to reduce all-cause mortality and liver related adverse health consequences through the achievement of virologic cure as evidenced by sustained virologic response or SVR. Furthermore, treatment is recommended for all persons with acute or chronic HCV infection regardless of symptoms, acuity/chronicity except for those with a short-life expectancy that can't be remedied by HCV treatment. Evaluation for treatment recommends that patients be evaluated for existence and presence of liver disease, specifically liver fibrosis to stratify patients for appropriate liver disease care, not for treatment selection. This evaluation can be done in non-invasive ways through physical exam, serum tests (i.e., FIB-4, APRI, Fibrosure and ELF), elastography (ideal tool but limited availability in point of contact testing/treatment) and imaging (limited availability in point of contact testing/treatment). Persons with cirrhosis need to be linked to care to ensure management of liver disease as they remain at risk of liver disease progression despite successful HCV treatment.

The ideal model for streamlined HCV diagnosis and treatment would begin with a single, ideally rapid CLIA-waived test sufficient for HCV diagnosis that does not require venipuncture followed by on-site/same-day treatment initiation with minimal post treatment monitoring.[11] While ideal, we are many steps away from truly achieving this ideal model though we will focus on the improvements needed for diagnostic testing.

New Diagnostic Approaches Needed

1. **Affordable rapid, CLIA-waived POC testing with rapid results (<30 minutes) to allow for patient evaluation and interpretation of test results in one visit with priority for:**
    a. Detection of HCV viral markers: HCV RNA (or HCV cAg).
    b. Detection of HBsAg (One test available outside the US that has been submitted for prequalification to WHO with results in 15 minutes)
    c. Multiplex assays to detect HIV, HBV, HCV concurrently (there are laboratory-based molecular platforms with approved multiplex assays approved for organ/transfusion screening but not diagnosis)
    d. Need to determine what would be sufficient/acceptable as far as performance, turn around time and cost from multiple perspectives including FDA (performance), patients, providers (turnaround time and cost) as well as insurance carriers (cost).

Opportunities for Improvement of Current Diagnostic Methods or Approaches

1. **Revisit guidelines to streamline treatment initiation prior to pre-treatment assessment**
    a. Refining/updating minimal assessment for patients who would benefit from immediate or near-immediate treatment start (i.e., significant risk of loss-to follow-up). (AASLD/IDSA)

b. Clarify/Update the “must assess” which are required whether to treat, when to treat or how to treat versus things that would be “assess as possible/after initiation” which would be relevant to patient care but wouldn’t be required to initiate treatment.
c. Consideration for removal of fibrosis assessment for all patients and shift to focus on higher-risk individuals.

2. **Reconsider on-treatment monitoring requirements to allow for minimal monitoring/follow-up or remote monitoring.**
3. **Need pre-approved regimens or for sites to purchase supplies to stockpile and have take-home treatment at high incidence or remote sites**
4. **Use of peer-navigators to help with complex systems and overcome barriers of stigma**

Barriers to be Addressed

1. Need long acting injectables especially in populations at high-risk for loss to follow-up.
2. Even if available, it is likely that a CLIA-waived or near patient HCV RNA test will be expensive and access/affordability will need to be addressed.
3. Continue to remove/reduce barriers such as prior authorization (9 have been removed so far), sobriety (13 states), disease severity and specialized healthcare provider (18 states).
4. Cost of pangenotypic regimens
5. Implementing minimal monitoring/removal of SVR12 testing.
6. Policy and system-wide solutions are needed
    a. Commitment to elimination—need to meet need with funding
    b. Public-private partnerships for diagnostic development and subsidize treatment

Other Considerations

1. Settings for implementation should include those where persons have chance/brief encounters with healthcare such as: substance use disorder treatment facilities, correctional facilities, syringe service programs, mobile treatment settings, primary care settings encountering persons at high risk (i.e., FQHCs), inpatient settings or emergency departments that deal with consequences of IDU, obstetrics (deferral of therapy until after delivery).
2. Consideration for limited contact for maximal improvement: linkage to care, ensuring minimal monitoring and one and done/test and treat to minimize barriers and delays in the care cascade such as the injectable long-acting antivirals.

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Anne Gaynor, PhD

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Appendix A. Key Question and Panelists

#	Key Question	Moderator	Presenter	Panelists
1	What HCV diagnostic tools are needed to optimize diagnosis of current HCV infection in moderate to high volume laboratories performing moderate or high complexity testing?	Michael Busch	Joseph Yao	Monica Parker Liisa Randall Lesley Miller
2	What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in low volume settings performing moderate complexity laboratory testing or CLIA-waived testing in clinical settings?	Tanya Applegate	Stacey Trooskin	William Meyer Biz McChesney Arthur Kim
3	What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in outreach settings and self-testing in a non-clinical setting?	Judith Feinberg	Kimberly Page	Marty Soehnlen Colleen Flanigan Lynn Taylor
4	What other tools are needed to support same-day diagnosis and treatment of current HCV infection?	John Ward	Marc Ghany	Marc Ghany Jorge Mera Benjamin Pinsky

Appendix B: Invited Participant List

Name	Title/Affiliation	Email Address
Anita Sands, BSc(Hons), MPH	World Health Organization	sandsa@who.int
Anna Lok, MD	University of Michigan	aslok@med.umich.edu
Annette Gaudino	Director of Policy Strategy Treatment Action Group	annette.gaudino@treatmentactiongroup.org
Arthur Yu-shin Kim, MD	Massachusetts General Hospital and Harvard Medical School	akim1@mgh.harvard.edu
Benjamin Pinsky, MD, PhD	Stanford University School of Medicine	bpinsky@stanford.edu
Biz McChesney	HIV and Hepatitis Prevention Program Iowa Department of Public Health	biz.mcchesney@idph.iowa.gov
Carl Li, MD, MPH	Centers for Medicare and Medicaid Services	carl.li@cms.hhs.gov
Carolyn Wester, MD, MPH	Director, Division of Viral Hepatitis Centers for Disease Control and Prevention	nhe3@cdc.gov
Charles Walworth, MD	Associate VP, Medical Affairs and Education Labcorp	walworc@labcorp.com
Chinedu R Okeke MD, MPH-TM, MPA	Acting Chief Medical Officer Health and Human Services, Office of the Assistant Secretary for Health (OASH), Office of Infectious Disease and HIV/AIDS Policy (OIDP)	chinedu.okeke@hhs.gov
Colleen Flanigan, RN, MS	Director, Bureau of Hepatitis Health Care New York State Department of Health	colleen.flanigan@health.ny.gov
Danae Bixler, MD, MPH	Medical Officer, Division of Viral Hepatitis Centers for Disease Control and Prevention	nqd0@cdc.gov
Daniel Church, MPH	Epidemiologist Massachusetts Department of Public Health	daniel.church@mass.gov
Daniel Raymond	National Viral Hepatitis Roundtable	daniel@nvhr.org
David L Thomas, MD, MPH	Johns Hopkins Medicine	dthomas@jhmi.edu
David Spindell, MD	Vice President Medical and Governmental Affairs OraSure Technologies	dspindell@orasure.com
Emi Okamoto, MD	Clinton Health Access Initiative	eokamoto@clintonhealthaccess.org
Gavin Cloherty, PhD	Abbott	gavin.cloherty@abbott.com

Appendix B: Participant List

Name	Title/Affiliation	Email Address
Hema Kapoor MD, D(ABMM), SM	Senior Medical Director Quest Diagnostics	Hema.x.kapoor@questdiagnostics.com
Jayme Parker, PhD, MB(ASCP)	Health Program Manager IV, Chief Alaska State Public Health Labs, Division of Public Health, DHSS	jayme.parker@alaska.gov
Jennifer Rakeman, PhD	Cepheid	jennifer.rakeman@cepheid.com
John W Ward, MD	Coalition for Global Hepatitis Elimination/Task Force for Global Health	jward@taskforce.org
Jonathan Mermin, MD, MPH	Centers for Disease Control and Prevention, Division of Viral Hepatitis	jhm7@cdc.gov
Jordan Feld, MD, MPH	University Health Network, Toronto Centre for Liver Disease	jordan.feld@uhn.ca
Jorge Mera, MD	Cherokee Nation Health Services	jorge-mera@cherokee.org
Joseph D. Yao, MD	Mayo Clinic and Mayo Clinic Laboratories	jdcyao@mayo.edu
Judith Feinberg, MD	Professor of Behavioral Medicine and Psychiatry & Professor of Medicine/ Infectious Diseases; Dr E.B. Flink Vice Chair of Medicine for Research West Virginia University School of Medicine	judith.feinberg@hsc.wvu.edu
Julie Dyall, PhD	Program Officer NIH/NIAID/DMID	dyallj@niaid.nih.gov
Karen Harrington, PhD	Sr. Manager Scientific Affairs Hologic, Inc.	karen.harrington@hologic.com
Kathleen (Kat) B. Whitaker, PhD	Division of Microbiology Devices, Center for Devices and Radiological Health, US Food and Drug Administration	kathleen.whitaker@fda.hhs.gov
Kimberly Page, PhD, MPH, MS	Professor University of New Mexico Health Sciences Center	pagek@salud.unm.edu
Kristen Marks, MD	Weill Cornell Medicine	markskr@med.cornell.edu
Laura Gillim, PhD	Labcorp	gilliml@labcorp.com
Lesley Miller, MD, FACP	Emory University School of Medicine	lesley.miller@emory.edu
Liisa M. Randall, PhD	Bureau of Infectious Disease and Laboratory Sciences, Massachusetts Department of Public Health	liisa.randall@mass.gov

Appendix B: Participant List

Name	Title/Affiliation	Email Address
Lily Li, MD, PhD, MBA	Medical Safety Officer/Medical Director Ortho Clinical Diagnostics	lily.li@orthoclinicaldiagnostics.com
Lynn E. Taylor, MD	CODAC Behavioral Health and University of Rhode Island	letaylor@uri.edu
Marc Ghany, MD, MHSc	NIH	marcg@intra.niddk.nih.gov
Maria Ines Garcia, PhD	Assistant Director, Division of Microbiology Devices Center for Devices and Radiological Health, US Food and Drug Administration	Maria.Garcia@FDA.HHS.GOV
Marty Soehnlen, PhD, MPH, PHLD(ABB)	Michigan Department of Health and Human Services	SoehnlenM@Michigan.gov
Michael Ninburg, MPA	National Viral Hepatitis Roundtable (NVHR)	mhninburg@hepeducation.org
Michael P. Busch, MD, PhD	Vitalant Research Institute / University of California San Francisco	mbusch@vitalant.org
Mona Doshani, MD/MPH	Medical Epidemiologist, Division of Viral Hepatitis Centers for Disease Control and Prevention	imf6@cdc.gov
Monica Parker, PhD	Laboratory Chief, Bloodborne and Parasitic Diseases; Director, Bloodborne Viruses Laboratory Wadsworth Center, New York State Department of Health	monica.parker@health.ny.gov
Nathan Furukawa, MD, MPH	Division of Viral Hepatitis Centers for Disease Control and Prevention	Nmt6@cdc.gov
Niklas Luhmann, MD, MscPH	WHO - HQ	luhmannn@who.int
Norah Terrault, MD, MPH	USC	terrault@med.usc.edu
Paige Armstrong, MD, MHS	Associate Director for Global Health, Division of Viral Hepatitis Centers for Disease Control and Prevention	yzu9@cdc.gov
Pedro Rodriguez, PhD	Roche Diagnostics, Medical and Scientific Affairs	pedro.rodriguez.pr3@roche.com
Rachel McLean, MPH	Chief, Policy and Viral Hepatitis Prevention Section California Department of Public Health, STD Control Branch	Rachel.McLean@cdph.ca.gov
Rajen Koshy, PhD	National Institute of Allergy and Infectious Diseases, NIH	rkoshy@niaid.nih.gov

Appendix B: Participant List

Name	Title/Affiliation	Email Address
Randy Mayer, MS, MPH	Chief, Bureau of HIV, STD, and Hepatitis Iowa Department of Public Health	Randall.Mayer@idph.iowa.gov
Ravi Jhaveri, MD	Professor of Pediatrics Ann & Robert H. Lurie Children's Hospital of Chicago/Northwestern University Feinberg School of Medicine	ravi.jhaveri@northwestern.edu
Raymond T Chung, MD	Professor of Medicine Massachusetts General Hospital, Harvard Medical School	chung.raymond@mgh.harvard.edu
S. Michele Owen, PhD	Assoc Director for Laboratory Science National Center for HIV, Viral Hepatitis, STD and TB Centers for Disease Control and Prevention	smo2@cdc.gov
Sai Patibandla, PhD	Senior Director Siemens-Healthineers	sai.patibandla@siemens-healthineers.com
Saleem Kamili, PhD	Chief, Laboratory Branch, Division of Viral Hepatitis Centers for Disease Control and Prevention	sek6@cdc.gov
Silke Schlottmann, PhD	Team Lead General Virology and Hepatitis Branch, Division of Microbiology Devices Center for Devices and Radiological Health, US Food and Drug Administration	silke.schlottmann@fda.hhs.gov
Sonjelle Shilton, MPH	Hepatitis Lead FIND	sonjelle.shilton@finddx.org
Stacey Trooskin, MD, PhD	Philadelphia FIGHT Community Health Centers	strooskin@fight.org
Susanna Naggie, MD, M.H.S.	Vice Dean of Clinical Research, Associate Professor of Medicine Duke University School of Medicine	susanna.naggie@duke.edu
Tanya Applegate, PhD	Senior Lecturer, Surveillance and Evaluation Research Program Kirby Institute	tapplegate@kirby.unsw.edu.au
Thaddeus Pham	Viral Hepatitis Prevention Coordinator/BS Hawai'i Department of Health	thaddeus.pham@doh.hawaii.gov
Tonya Hayden, PhD	Deputy Chief, Laboratory Branch, Division of Viral Hepatitis Centers for Disease Control and Prevention	zdy0@cdc.gov

Appendix B: Participant List

Name	Title/Affiliation	Email Address
William A. Glover II, PhD	Assistant Director, Infectious Diseases, North Carolina State Laboratory of Public Health	William.Glover@dhhs.nc.gov
William A. Meyer III, PhD, D(ABMM), MLS(ASCP)CM	Quest Diagnostics	William.A.Meyer@questdiagnostics.com

873

874 Invited: Unable to Participate

875

Name	Title/Affiliation	Email Address
Jason Grebely, PhD	Professor The Kirby Institute, UNSW Sydney	jgrebely@kirby.unsw.edu.au
Philippa Easterbrook, MD	WHO	easterbrookp@who.int
Cody J. Shafer	Iowa Department of Public Health	Cody.shafer@idph.iowa.gov

876

877 Appendix C: Meeting Agenda

878 # DAY 1: OCTOBER 19, 2021

TIME	TOPIC	PRESENTER/FACILITATOR
1:00-1:20pm	**Welcome**	
1:04-1:09pm	Welcome from NCHHSTP Director	Jonathan "Jono" Mermin, CDC
1:09-1:20pm	Meeting Objectives and Logistics	Anne Gaynor, APHL
1:20-2:10pm	**Opening Session**	
1:20-1:30pm	The Role of Testing in Advancing Hepatitis C Elimination	Carolyn Wester, CDC
1:30-1:40pm	Down-Classification of Hepatitis C Virus Diagnostics	Maria Ines Garcia, FDA
1:40-1:50pm	HCV Diagnostic Tools-in the Development Pipeline	Sonjelle Shilton, FIND
1:50-2:10pm	What is needed to move toward single-step diagnosis of current HCV infection?	Jordan Feld, Toronto Centre for Liver Disease
2:10-2:15pm	**Break**	
2:15-3:30pm	**Key Question 1:** What HCV diagnostic tools are needed to optimize diagnosis of current HCV infection in moderate to high volume laboratories performing moderate or high complexity testing?	Michael Busch, Vitalant Research Institute
2:17-2:32pm	Presentation	Joseph Yao, Mayo Clinical Lab
2:32-2:41pm	Panelist Remarks	Monica Parker, Wadsworth Center Liisa Randall, Massachusetts DPH Lesley Miller, Emory University
2:41-2:51pm	Invited Comments	FDA, CMS, Diagnostic Companies
2:51-3:30pm	Facilitated Discussion	Participants
3:30-3:40pm	**Break**	
3:40-4:55pm	**Key Question 2:** What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in low volume settings performing moderate complexity laboratory testing or CLIA-waived testing in clinical settings?	Tanya Applegate, Kirby Institute
	Presentation	Stacey Trooskin, Fight.org
	Panelist Remarks	William Meyer, Quest Biz McChesney, Iowa DPH Arthur Kim, MGH/Harvard
	Invited Comments	FDA, CMS, Diagnostic Companies
	Facilitated Discussion	Participants
4:55-5:00pm	**Wrap-up and Closing**	
	Close out & preview of the next day	Anne Gaynor, APHL

879

880

DAY 2: OCTOBER 20, 2021

TIME	TOPIC	PRESENTER/FACILITATOR
1:00-1:05pm	**Welcome and Recap**	Anne Gaynor, APHL
1:05-2:20pm	**Key Question 3:** What HCV diagnostic tools are needed to advance diagnosis of current HCV infection in outreach settings and self-collection/self-testing in non-clinical settings?	Judith Feinberg, WVU Medicine
	Presentation	Kimberly Page, U. New Mexico
	Panelist Remarks	Marty Soehnlen, Michigan PHL Colleen Flanigan, NYSDOH Lynn Taylor, U. Rhode Island
	Invited Comments	FDA, CMS, Diagnostic Companies
	Facilitated Discussion	Participants
2:20-2:25pm	**Break**	
2:25-3:35pm	**Key Question 4:** What other tools are needed to support same-day diagnosis and treatment of current HCV infection?	John Ward, Task Force for Global Health
	Presentation	Ray Chung, Mass General Hospital
	Panelist Remarks	Marc Ghany, NIDDK Jorge Mera, Cherokee Nation HS Benjamin Pinsky, Stanford Health
	Invited Comments	FDA, CMS, Diagnostic Companies
	Facilitated Discussion	Participants
3:35-3:40pm	**Break**	
3:40-4:50pm	**Final Session: Recommendations, Prioritization, Other Considerations**	APHL and Presenters
3:40-3:45pm	Overview of Session	Anne Gaynor, APHL
3:45-4:25pm	Refinement of Key Questions	Joseph Yao, Mayo Clinical Lab Stacey Trooskin, Fight.org Kimberly Page, U. New Mexico Ray Chung, Mass General Hospital
4:25-4:50pm	Overall Recommendations and Needs	Kelly Wroblewski, APHL
4:50-5:00pm	**Next Steps and Closing**	Anne Gaynor, APHL Carolyn Wester, CDC

Appendix D: Disclosures

Name	Commercial Entity	Relationship
Anna Lok	Gilead Sciences	Research Grant
Arthur Kim	Kinto Pharmaceuticals	Data Monitoring Committee, DSMB
David Thomas	Merck	Advisory, DSMB
David Thomas	Excision Bio	Advisory
Hema Kapoor	Quest	Employee and Stockholder
Jennifer Rakeman	Cepheid	Employee
Joseph Yao	Abbott Molecular, Bio-Rad Laboratories, Ortho Clinical Diagnostics, Roche	Advisory board member; research funding support
Karen Harrington	Hologic, Inc.	Employee
Lesley Miller	Gilead Sciences	Grant Funding through Emory University
Lesley Miller	AbbVie	Advisory Board
Lily Li	Ortho Clinical Diagnostics	Employee
Lynn Taylor	Up to Date	Royalties
Marty Soehnlen	Catalyst Diagnostics LCC	Contracted Laboratory Director
Michael Busch	Abbott, Bio-Rad Laboratories, Grifols, Hologic, Ortho Clinical Diagnostics, Roche	Grant Funding to Employer/Institution
Norah Terrault	Gilead Sciences, Genentech Roche, EXIGO Mgnt LLC, ENYO, PPD Pharma, Entourage	Consultant/Research
Pedro Rodriguez	Roche Diagnostics Corp.	Employee
Ravi Jhaveri	AstraZeneca (Flu vaccine), Seqirus (Flu vaccine), Dynavax (Adjuvanted Hep B vaccine)	Consultant
Ravi Jhaveri	Elsevier (Co-EiC of journal Clinical Therapeutics)	Editorial Stipend
Raymond Chung	AbbVie Pharmaceuticals, Gilead Sciences, BMS, Janssen, Boehringer, Roche	Research Grant
Stacey Trooskin	Gilead Sciences	Grant Funding to Institution, Advisory Board
Susanna Naggie	AbbVie Pharmaceuticals, BioMarin Pharmaceutical, Inc., Bristol-Myers Squibb/PRA, Gilead Sciences, Inc., IAS-USA, Theratechnologies	Consultant
Susanna Naggie	Vir Biotechnology	Interest
Tonya Applegate	Cepheid, Abbott, SpeeDx	Research Support
Tonya Applegate	FIND	Reviewer
William Meyer	Quest	Employee
John Ward	Abbott, Gilead, AbbVie, Merck, Siemens, Cepheid, Roche, Pharco, Zydus-Cadila, US Govt Agencies and Philanthropic Agencies	Funding to Employer for Coalition for Global Hepatitis Elimination efforts

*Disclosures for Invited Participants that did not attend are not included