ReportStream

Programmer's Guide for Organizations and Testing Facilities

VERSION 2.3 – AUGUST 2022

Introduction

ReportStream is a free, open-source data platform that makes it easy for public health data to be transferred from testing facilities to public health departments.

This programmer's guide enables those who are writing automated systems and tools to send laboratory and other health-related data to local, state, and federal jurisdictions. It helps you, the technical user at the testing facility or sending location, learn how to send data using the ReportStream Restful (REST) API.

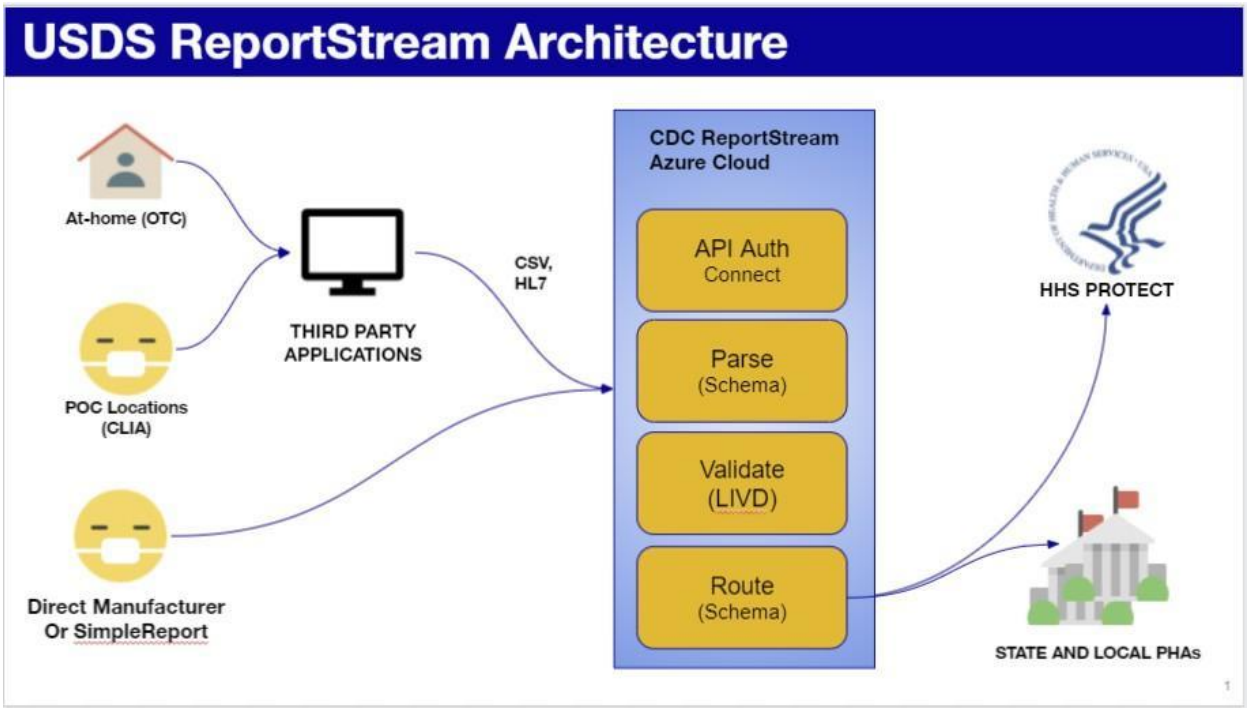
Examples in this guide use curl commands for simplicity with the assumption you'll be coding these calls into your sending system. You can also use a program like Postman to test submissions.

The **Waters API**—the primary secure entry point to ReportStream—is named in memory of Dr. Michael Stephan Waters (1973-2020) whose tireless work at the U.S. Food and Drug Administration championed diagnostic data interoperability efforts nationwide. ReportStream honors Dr. Waters through continuation and elevation of his work.

Release Notes

You can find ReportStream release notes here: https://github.com/CDCgov/prime-reportstream/blob/master/prime-router/docs/release-notes.md

Onboarding Process Summary



The above diagram represents a high-level outline of the steps involved in a typical ReportStream interaction for organizations and testing facilities.

Onboarding Steps

Step 1: Sample Data

You'll share artificially created data ("fake data")/non-PII example data with the ReportStream team via email. Currently, ReportStream can accept either a CSV file or HL7 input data. We'll work together to help you use one of our existing standard data models or derive new data models as needed. We'll provide detailed documentation for expected data types and values in your data model, as well as fake data or synthetic data using that model,

if needed.

Special Note for HL7 OTC Tests:

For this step, refer to the RADx MARS Getting Started guide located at https://www.nibib.nih.gov/covid-19/radx-tech-program/mars/hl7v2-getting-started. Within the online guide, you'll find information on field requirements, a tool outlining manufacturer-specific values, and a COVID-19 OTC-specific profile of the NIST HL7 v2 validator (to configure the validator, refer to "NIST HL7v2 validator instructions" at the bottom of the RADx MARS Getting Started guide).

Step 2: Onboard to Staging

After jointly agreeing on a stable draft or existing data model, the ReportStream team will onboard you to our staging environment. If using a shared secret key (described below), you'll need to set up an account in Keybase (more information in "Sending to ReportStream" section) so we can share the API Keys/tokens and the URL with you. We expect you'll keep all such private information secured both at rest and in transit.

You can use curl commands, Postman, or another method of your choosing to post test submissions to the staging environment. Using the Staging API, you can then test your automation code as well as your code that handles responses. **Do not send any PII or PHI to the Staging system—only fake/ dummy/ example/ synthetic data is acceptable.** Let us know when you send submissions to the Staging environment. We'll review that data and work with you to correct any issues. Feel free to send as many fake data submissions to staging as you like.

Step 3: Onboard to Production in Training Mode

Before the ReportStream team can onboard you to our production system in "Training" mode,

we'll ask you to sign our Terms of Service (TOS) agreement and jointly agree on a stable final data model. If using a shared secret key, you'll receive API Keys/tokens and the URL via Keybase. ReportStream doesn't forward or transport data received in training mode; however, the response message provides detailed information on where your data would've flowed if production mode was active.

Step 4: Production

After jointly agreeing on a training end date, the ReportStream team will enable full production mode, with data automatically flowing to appropriate state, local, and federal jurisdictional systems.

Sending to ReportStream

There are two methods of authenticating to ReportStream's REST API token-based authentication with a public/private key pair and using a shared secret API key. Token-based authentication is recommended best practice.

As part of the onboarding process, the ReportStream team will pre-configure ReportStream with your client information and give you a unique client-id. The client configuration tells ReportStream what type of data to expect for that client-id. ReportStream will use the client-id to look up the associated data model and format (CSV, HL7), and validate the attached payload.

The examples below assume a client-id "healthy-labs". The examples submit the payload contained in the file `./healthy-labs-nonPII-data.csv (or .hl7)`. In the examples, data are submitted via an HTTP POST to the ReportStream Staging (test) system `reports` endpoint. The data submitted are sent as the payload of the POST, as is, with no changes.

Example of Token-based authentication with public/private key pair

Step 1: Prior to submission, send your public key to ReportStream

Prior to connecting to the endpoint, you'll need a public/private keypair. There are many way to do this. The steps below show how to create a key pair using `openssl`.

EC

```
openssl ecparam -genkey -name secp384r1 -noout -out my-es-keypair.pem
openssl ec -in my-es-keypair.pem -pubout -out  my-es-public-key.pem
```

RSA

```
openssl genrsa -out my-rsa-keypair.pem 2048
openssl rsa -in my-rsa-keypair.pem -outform PEM -pubout -out my-rsa-public-key.pem
```

Send the public key to the ReportStream team (they'll associate it with your configuration within ReportStream). Once configured, continue with the steps below (they're typically automated and run from a server).

You only need to do this step once, not every time you submit. You can submit replacement keys to ReportStream at any time, following the steps above.

Step 2: At the Time of Submission, generate a signed JWT using your private key

A JWT is a base64 encoded string that has three parts: header, payload, and signature.

Here is an example of header and payload data that should appear in a ReportStream JWT, prior to signature (This example is for a dummy client-id 'healthy-labs', submitting to ReportStream's STAGING system):

```
{
  "header": {
    "kid": "healthy-labs.default",
    "typ": "JWT",
    "alg": "RS256"
  },
  "payload": {
    "iss": "healthy-labs.default",
    "sub": "healthy-labs.default",
    "aud": "staging.prime.cdc.gov",
    "exp": 1660737164,
    "jti": "4b713fcd-2514-4207-b310-620b95b749c5"
  }
}
```

- The exp (Expiration time) should be a Unix time, 5 minutes after the time the token was generated.

- The jti (JWT ID) should be random unique string, new with every call.
- Generate the signed JWT using your private key.

An example python program to generate a valid JWT can be found in github here: https://github.com/CDCgov/prime-reportstream/tree/master/prime-router/examples/generate-jwt-python/

Step 3: Send the signed JWT to ReportStream, to get a temporary bearer token

POST to the token URL with the following parameters, replacing <token-signing-secret> with your JWT from above. In the URL below, be sure to replace the dummy string 'healthy-labs' with your client-id, as assigned to you by ReportStream staff. Here is an example 'curl' POST:

```
curl -X POST -H "content-length:0" "https://staging.prime.cdc.gov/api/token?scope=healthy-
labs.default.report&grant_type=client_credentials&client_assertion_type=urn:ietf:params:oauth:cl
ient-assertion-type:jwt-bearer&client_assertion=<token-signing-secret>"
```

You should get something like this back, which will be valid for 5 minutes:

```
{"access_token":"<long-access-
token>","token_type":"bearer","expires_in":300,"expires_at_seconds":1625260982,"scope":"healthy-
labs.default.report"}
```

Step 4: Submit data to ReportStream using the bearer token

Use the access token returned above as the bearer token for the submission:

```
curl -H "authorization:bearer <long-bearer-token>" -H "client:healthy-labs"  -H "content-
type:text/csv" --data-binary "@./healthy-labs-nonPII-data.csv"
"https://staging.prime.cdc.gov/api/waters"
```

HL7 example:

```
curl -H "authorization:bearer <long-bearer-token>" -H "client:healthy-labs"  -H "content-
type:application/hl7-v2" --data-binary "@./healthy-labs-nonPII-data.hl7"
"https://staging.prime.cdc.gov/api/waters"
```

Again, always remember to replace 'healthy-labs' client-id with the client-id supplied to you by ReportStream staff.

Example of Shared Secret Key Authorization

Here's an example bash shell curl command submission to ReportStream using a shared

secret API key. The command submits the contents of the file ‘./healthy-labs-nonPII-data.csv‘ to the endpoint using the client name healthy-labs. You’ll use your own client name and your own token (API key).

The ReportStream team will provide you with the token to use as the x-functions- key value for submissions to that client-id. We’ll share secrets using Keybase, so you’ll need to have a Keybase account (if you don’t have a Keybase account, set one up at https://keybase.io).

```
curl -X POST -H “client:healthy-labs” -H “content-type:text/csv” –data-binary
“@./healthy-labs-nonPII- data.csv” -H “x-functions-key:<place-token-here>”
https://staging.prime.cdc.gov/api/reports
```

Here’s an example HL7 submission:

```
curl -X POST -H “client:super-labs” -H “content-type:application/hl7-v2” –data-binary
“@./super-labs-nonPII- data.hl7” -H “x-functions-key:<place-token-here>”
https://staging.prime.cdc.gov/api/reports
```

(See “Appendix A: Fields List” for field definitions and sample values. See the “Appendix B: Sample Payloads and Output” for sample data and expected output.)

Notes

- There’s a flag allowing partial submissions. With this flag, successful elements in a batch will succeed, and the unsuccessful ones won’t. This flag requires extra code on your part to handle partial failures.

- Here’s the complete end point input and response OpenAPI specification.

Responses from ReportStream

ReportStream responds to each API call with a response (JSON formatted) about the disposition of your data.

Errors and warnings

The ReportStream response may include warnings and/or errors based on validation of the submission against the expected schema (schemas are described in "Appendix C: ReportStream Data Models").

A successfully accepted submission returns a 201 "httpStatus" code. Submissions with *warnings* but no errors will still be accepted. However, one or more *errors* fail the entire submission (the entire batch).

Common errors

- Missing or mislabeled required columns/fields
- Missing or malformed data in required columns/fields
- CSV with "jagged" rows—differing number of columns within the payload
- Empty payload (an empty response is often a sign of a failed authorization, with a 401 response status). Make sure your token and the URL are correct.
- Incorrect client-id or other headers
- Incorrect data types (send a character string when a numeric value is expected)

Common validation warnings

- Missing optional columns/fields

- Missing or malformed data in optional columns/fields

Response Messages

Below is an example JSON response to a submission. This is a successful response to a 'synchronous' submission to ReportStream, typical of what lower volume users receive.


```
{
    "submissionId": 1588,
    "timestamp": "2022-02-09T16:59:33.789532Z",
    "sender": "simple_report",
    "reportItemCount": 2,
    "httpStatus": 201,
    "id": "e8880dcf-a201-4690-8e02-2871da739b61",
    "destinationCount": 2,
    "destinations": [
        {
            "organization_id": "de-dph",
            "service": "elr",
            "filteredReportRows": [],
            "sending_at": "2022-02-09T17:00:00.000000Z",
            "itemCount": 1,
            "sentReports": [ ],
            "organization": "Delaware Division of Public Health"
        },
        {
            "organization_id": "hi-phd",
            "service": "elr",
            "filteredReportRows": [],
            "sending_at": "2022-02-09T19:00:00.000000Z",
            "itemCount": 1,
            "sentReports": [ ],
            "organization": "Hawaii Public Health Department"
        }
    ],
    "errors": [],
    "warnings": [],
    "topic": "covid-19",
    "warningCount": 0,
    "errorCount": 0
}
```


Since the response is returned in real-time, the “destinations” section supplies information about where the submission is *expected* to be sent.

ReportStream features a History Details API that can be later queried to obtain the actual destinations and relevant detail. If you’d like to use this API, let the ReportStream team know, and we’ll provide you with additional information about requirements for Okta authentication.

The request is made with the submissionId, above:

```
https://prime.cdc.gov/api/history/simple_report/submissions/1588
```

Response:


```
{
    "submissionId": 1588,
    "timestamp": "2022-02-09T16:59:33.789532Z",
    "sender": "simple_report",
    "reportItemCount": 2,
    "httpStatus": 201,
    "id": "e8880dcf-a201-4690-8e02-2871da739b61",
    "destinationCount": 2,
    "destinations": [
        {
            "organization_id": "de-dph",
            "service": "elr",
            "filteredReportRows": [],
            "sending_at": "2022-02-09T17:00:00.000000Z",
            "itemCount": 1,
            "sentReports": [
                {
                    "reportId": "38c84ec2-5741-4f2f-b234-25d774ec8caf",
                    "externalName": "covid-19-43d64e18-ce56-482a-9134-f9f84a2c9d6f-
20220209170000.hl7",
                    "createdAt": "2022-02-09T17:00:02.825148Z",
                    "itemCount": 1
                }
            ],
            "organization": "Delaware Division of Public Health"
        },
        {
            "organization_id": "hi-phd",
            "service": "elr",
            "filteredReportRows": [],
            "sending_at": "2022-02-09T17:00:00.000000Z",
            "itemCount": 1,
            "sentReports": [
                {
                    "reportId": "d9fae107-ef89-4fc0-b9b9-517219a4d2bb",
                    "externalName": "covid-19-3560b0e8-c183-4132-ad0c-487a837f0e77-
20220209170000.hl7",
                    "createdAt": "2022-02-09T17:00:02.822125Z",
                    "itemCount": 1
                }
            ],
            "organization": "Hawaii Public Health Department"
        }
    ],
    "errors": [],
    "warnings": [],
    "topic": "covid-19",
    "warningCount": 0,
    "errorCount": 0
}
```

The sentReports sections contain details about where and when the reports were transmitted.

Asynchronous Processing

In most cases, we'll ask high volume users to submit via ReportStream Async Processing. This ReportStream configuration setting is automatically enabled for users. Upon submitting data via ReportStream Async Processing, the REST endpoint returns almost immediately; however, ReportStream doesn't return information about where the COVID-19 tests will be sent.

Here is an example ReportStream response to an Async submission:


```
{
   "submissionId":1604,
   "timestamp":"2022-02-10T13:50:19.162694Z",
   "sender":"simple_report.default",
   "httpStatus":201,
   "id":"3597ad7d-b92c-4bc0-a8fc-d909ed87bc90",
   "reportItemCount":2,
   "destinationCount":0,
   "destinations": [],
   "errors": [],
   "warnings": [],
   "topic":"covid-19",
   "warningCount":0,
   "errorCount":0
}
```


In exchange for speed, the async submission response provides less initial information in the JSON. The initial response will provide errors and warnings, but no destination or filter information. The History Details API can be queried later to get full information about expected and actual destinations.

Error Responses

In error cases, no report "id" UUID is returned, because no report was created based on the submission.

Example failure response (and identical HistoryAPI response). Note the "id" is null, and the “httpStatus” is not 201.


```
{
    "submissionId": 1594,
    "timestamp": "2022-02-09T20:44:55.055545Z",
    "sender": "simple_report",
    "destinationCount" : 0,
    "httpStatus": 400,
    "id": null,
    "destinations": [],
    "errors": [
        {
            "scope": "item",
            "index": 1,
            "trackingId": "abcde",
            "type": "error",
            "message": "Blank value for element 'Patient_last_name' ('patient_last_name')"
        }
    ],
    "warnings": [],
    "topic": null,
    "warningCount": 0,
    "errorCount": 1
}
```


An example of a report level error:


```
{
    "submissionId": 1599,
    "timestamp": "2022-02-09T20:56:16.82117Z",
    "sender": "strac",
    "httpStatus": 400,
    "id": null,
    "destinationCount" : 0,
    "destinations": [],
    "errors": [
        {
            "scope": "report",
            "index": null,
            "trackingId": null,
            "type": "error",
            "message": "CSV file has an inconsistent number of columns on row: 3"
        }
    ],
    "warnings": [],
    "topic": null,
    "warningCount": 0,
    "errorCount": 1
}
```

Fast Facts for ReportStream Users

- Data is sent in the HTTP payload, either in CSV or HL7 2.5.1 format.
- You can send a single record or up to 10,000 records in a single submission.
- You can send as often as you want.
- ReportStream will automatically filter, transform, batch, and forward data to local, state, and federal jurisdictions based on both geographical and data quality filters provided by those jurisdictions.
- ReportStream is not a permanent repository, EMR, or registry for health data. We only keep the data long enough to ensure it gets to the proper local, state, and federal jurisdictions.
- It's often easier to look at sample data than at a schema. The ReportStream team can send you fake data files. We can synthesize data in CSV based on any of our schemas. The fake data will always successfully validate against the schema used to generate it. We've made efforts to make many datatypes like names, addresses, and LOINC and SNOMED code value sets look somewhat real. Since it's computer-generated, the fake data may look strange.

Appendix A: Field List

API CSV AND HL7 FIELD REQUIREMENTS

Legend:

- "Yes" means this is a required field for acceptance
- "Yes – Conditional" means this field is required, but only under certain circumstances. Review the field's Data Requirements and Additional Guidance for more information.
- "Requested" means that this field should be populated if available. In addition, some states may treat this as a required field.
- "No" means that this field is not a hard requirement. In the interest of providing complete information to public health agencies, please populate the field if data is available.

Special notes:

- OTC reporting has slightly different requirements:
  - For CSV implementations, include only the columns marked with "(OTC)" in the CSV Column Names below.
  - For HL7 implementations, do not use this table. Refer to the RADx MARS OTC information in Step 1: Sample Data from the onboarding process outlined previously.
- Two of the most important and often overlooked pieces of required data are the deviceIdentifier (OBX-17.1) and testPerformed (OBX-3.1). These fields must match exactly to the appropriate row in the LOINC In Vitro Diagnostic (LIVD) test code mapping. The most updated mapping can be found at https://www.cdc.gov/csels/dls/sars-cov-2-livd-codes.htm. Specifics about each field are detailed in the tables below.
- The preferred timestamp formatting for CSV and HL7 is yyyyMMddhhmmss+/-zzzz. If the UTC offset (+/-zzzz) is not present, results should be normalized to a single time zone that's agreed upon during the onboarding process.

Patient Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
patient_id (OTC)	PID-3.1	No	Requested	**Optional - Requested:** Enter unique patient identifier. This is typically the Medical Record Number. ***Do not send a Social Security Number.***	This value is optional and can be left blank if no information is provided. *Some jurisdictions may require this field, ReportStream will notify you if this is the case.*
patient_last_name (OTC)	PID-5.1	No	Yes	Enter patient's last name.	File will fail if field left blank.
patient_first_name (OTC)	PID-5.2	No	Yes	Enter patient's first name.	File will fail if field left blank.

patient_name_middle (OTC)	PID-5.3	No	No	**Optional:** Enter patient's middle name, if known.	This value is optional and can be left blank if no information is provided.
patient_street (OTC)	PID-11.1	No	Yes	Enter patient's home address.	File will fail if field left blank. If no address given or homeless, populate this field with ** Unknown / Not Given ** or ** Homeless **.
patient_street2 (OTC)	PID-11.2	No	No	**Optional:** Enter patient's additional address information, if applicable.	This value is optional and can be left blank if no information is provided.
patient_city (OTC)	PID-11.3	No	Yes	Enter patient's city.	File will fail if field left blank. If no city given or homeless, populate this field with the ordering facility information.
patient_state (OTC)	PID-11.4	No	Yes	Enter patient's state using the two-character abbreviation.	File will fail if field left blank. If no state given or homeless, populate this field with the ordering facility information.
patient_county (OTC)	PID-11.9	Yes	Yes	Enter patient's county/parish name.	
patient_zip_code (OTC)	PID-11.5	Yes	Yes	Enter patient's zip code. **Accepted Format:** 12345 12345-6789	File will fail if value is not entered using acceptable format or field is left blank. If no zip code given or homeless, populate field with the ordering facility information.
patient_phone_number (OTC)	PID-13.7	No	Yes - Conditional	Enter patient's phone number, if known. **Accepted Format:** 000-000-000	If no phone number given or homeless, populate field with the ordering facility information.
patient_dob (OTC)	PID-7.1	No	Yes	Enter patient's date of birth. **Accepted Format:** yyyyMMdd	File will fail if value is not entered using accepted format or field is left blank.
patient_gender (OTC)	PID-8.1	Yes	Yes	Enter patient's gender. **Accepted Values (HL70001):** ● M or Male ● F or Female ● O or Other ● U or Unknown ● A or Ambiguous ● N or Not applicable	File will fail if value not entered using accepted values or field is left blank. Accepted values come from values mapped to LOINC codes you can find in the PHIN VADS system.
patient_race (OTC)	PID-10.1	Yes	Yes	Enter patient's race. **Accepted Values (HL70005):** ● 1002-5 or American Indian or Alaska	File will fail if numeric values or text values are not entered using acceptable values or field is left blank. Accepted values come from values mapped to LOINC

				Native • 2028-9 or Asian • 2054-5 or Black or African American • 2076-8 or Native Hawaiian or Other Pacific Islander • 2106-3 or White • 2131-1 or Other • ASKU or Ask, but unknown • UNK or Unknown	codes you can find in the PHIN VADS system.
patient_ethnicity (OTC)	PID-22.1	Yes	Yes	Enter patient's ethnicity. **Accepted Values:** • 2135-2 or H or Hispanic or Latino • 2186-5 or N or Not Hispanic or Latino • UNK or U or Unknown	File will fail if numeric values or text values are not entered using acceptable values or field is left blank. Accepted values come from values mapped to LOINC codes you can find in the PHIN VADS system.
patient_preferred_language	PID-15	No	No	**Optional:** Enter patient's preferred language, if known. **Example Accepted Values:** eng OR English spa OR Spanish fre OR French jpn OR Japanese	Use the Concept Code or Concept Name from the PHIN VADS ISO-639 table, which can be found at https://phinvads.cdc.gov/vads/ViewValueSet.action?id=D0858308-9AB3-EA11-818F-005056ABE2F0#.
patient_email (OTC)	PID-13.4	No	No	**Optional:** Enter patient's email address, if known. **Accepted Value:** Numeric or text	This value is optional and can be left blank if no information is provided.

Order and Result Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
accession_number (OTC)	ORC-3.1 OBR-3.1 SPM-2.2 MSH-10 ORC-2.1 OBR-2.1	Yes	Yes		An accession number is a unique ID that identifies a single result. This field is important for public health departments to refer back to a test event. File will fail if field left blank.
equipment_model_name (OTC)	N/A	Yes	Yes	Enter equipment model name value from Department of Health and Human Services' (HHS) LOINC Mapping spreadsheet.	File will fail if value not entered using accepted values or field is left blank. Go to https://www.cdc.gov/csels/dls

				Examples: 1) "ID NOW" 2) "BD Veritor System for Rapid Detection of SARS-CoV-2*" 3) "BD Veritor System for Rapid Detection of SARS-CoV-2 & Flu A+B*" 4) "RightSign COVID-19 IgG/IgM Rapid Test Cassette*"	/sars-cov-2-livd-codes.html. Click on the Mapping Tool labeled "LIVD SARS-CoV-2 Test Codes.xlsx" to download the file. Locate the saved file on your computer and open it. Click on the "LOINC Mapping" tab. Go to Column B, labeled "Model" to locate the corresponding value to enter.
N/A	OBX-17.1	Yes	Yes	Enter device identifier from Department of Health and Human Services' (HHS) LOINC Mapping spreadsheet. **Examples:** 5) "00811877010616" 6) "BD Veritor System for Rapid Detection of SARS-CoV-2_Becton, Dickinson and Company (BD)" 7) "BD Veritor System for Rapid Detection of SARS-CoV-2 & Flu A+B_Becton, Dickinson and Company (BD)" 8) "RightSign COVID-19 IgG/IgM Rapid Test Cassette_Hangzhou Biotest Biotech Co., Ltd."	File will fail if value not entered using accepted values or field is left blank. Go to https://www.cdc.gov/csels/dls/sars-cov-2-livd-codes.html. Click on the Mapping Tool labeled "LIVD SARS-CoV-2 Test Codes.xlsx" to download the file. Locate the saved file on your computer and open it. Click on the "LOINC Mapping" tab. Go to Column M, labeled "Testkit Name ID" to locate the corresponding value to enter.
test_performed_code (OTC)	OBX-3.1	Yes	Yes	Enter TestPerformed Code value from Department of Health and Human Services' (HHS) LOINC Mapping spreadsheet. **Examples:** 1) "94534-5" 2) "94558-4" 3) "97097-0" 4) "94507-1" "94508-9"	File will fail if value not entered using acceptable values or field is left blank. Go to https://www.cdc.gov/csels/dls/sars-cov-2-livd-codes.html. Click on the Mapping Tool labeled "LIVD SARS-CoV-2 Test Codes.xlsx" to download the file. Locate the saved file on your computer and open it. Click on the "LOINC Mapping" tab. Go to Column F, labeled "Test Performed LOINC Code". Locate the corresponding value to enter.

test_result (OTC)	OBX-5.1	Yes	Yes	Enter a numeric SNOMED code (preferred) or common text value listed. **Examples:** "260373001" "Positive" "Negative" "Not Detected" "Detected" "Invalid Result"	File will fail if value is not entered using accepted text values or SNOMED codes, or if the field is left blank. Enter a value from the common values listed. Go to https://www.cdc.gov/csels/dls/sars-cov-2-livd-codes.html. Click on the Mapping Tool labeled "LIVD SARS-CoV-2 Test Codes.xlsx" to download the file. Locate the saved file on your computer and open it. Click on the "LOINC Mapping" tab. Go to Column E, labeled "Vendor Result Description". Locate SNOMED code value and enter into field (Example: Positive = 260373001).
order_test_date (OTC)	ORC-15.1	Yes	Yes	Enter test ordered date. **Accepted Format:** yyyyMMddhhmmss+/-zzzz	File will fail if value is not entered using acceptable format or field is left blank.
specimen_collection_date (OTC)	SPM-17.1	Yes	Yes	Enter specimen collection date. **AcceptedFormat:** yyyyMMddhhmmss+/-zzzz	If unknown, populate field with the order_test_date value. In most cases, these are the same. Can be left blank for CSV if same as order_test_date.
testing_lab_specimen_received_date (OTC)	SPM-18.1	No	No	Enter testing lab specimen received date. **AcceptedFormat:** yyyyMMddhhmmss+/-zzzz	If unknown, populate field with the order_test_date value. In most cases, these are the same. Can be left blank for CSV if same as order_test_date.
test_result_date (OTC)	OBX-14.1	Yes	Yes	Enter test result date. **Accepted Format:** yyyyMMddhhmmss+/-zzzz	File will fail if value is not entered using acceptable format or field is left blank.
date_result_released (OTC)	OBR-22	Yes	Yes	Enter test report date. **Accepted Format:** yyyyMMddhhmmss+/-zzzz	File will fail if value is not entered using acceptable format or field is left blank.
comment	NTE-3	No	No	Any comments from a physician	This value is optional and can

				or lab technician you want to relay to your public health department can be entered here. This field is not intended for characteristics of COVID-19 tests or statements about false positive or negative results.	be left blank if no information is provided. *Do not include commas (,) in any CSV comments unless the field is encapsulated in quotes (").*
test_result_status	OBX-11 OBR-25	Yes	Yes	**Accepted Values:** • "F" for Final Result. • "C" for Corrected Result	Enter test result status using the accepted format. If left blank, value will default to "F" for CSV.

Specimen Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
specimen_type (OTC)	SPM-4	Yes	Yes	Enter a numeric SNOMED code (preferred) or common text value listed. **Examples:** "697989009" "Nasal Swab" "Nasopharyngeal Swab" "Anterior Nares Swab" "Throat Swab" "Oropharyngeal Swab" "Whole Blood" "Plasma" "Serum"	File will fail if value not entered using acceptable text values or SNOMED codes or field is left blank. Go to https://www.cdc.gov/csels/dls/sars-cov-2-livd-codes.html. Click on the Mapping Tool labeled "LIVD SARS-CoV-2 Test Codes.xlsx" to download the file. Locate the saved file on your computer and open it. Click on the "LOINC Mapping" tab. Go to Column D, labeled "Vendor Specimen Description". Locate the corresponding text value or SNOMED code and enter into field (example: Anterior Nares Swab = "697989009").
	SPM-8	Requested	Requested	Enter a numeric SNOMED code for the specimen source site code.	For CSV, this is populated by ReportStream based on the specimen_type value.

Ordering Provider Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance

ordering_provider_id (OTC)	ORC-12.1	Yes	Yes	Enter National Provider Identifier (NPI). ReportStream prefers this value, however if NPI is unknown enter local coding. **Examples:** ● NPI example: 1013012657 ● Local code example: muc1290	NPI is a 10-character all-numeric identification number to uniquely identify a health care provider. NPIs can be found at https://npiregistry.cms.hhs.gov/. *Some jurisdictions may not accept a local code, ReportStream will work with you if this is the case*. This field may be left blank for OTC tests.
ordering_provider_last_name (OTC)	ORC-12.2	No	Yes	Enter the last name of the ordering provider.	File will fail if field left blank.
ordering_provider_middle_name (OTC)	ORC-12.4	No	No	**Optional:** Enter ordering provider's middle name, if known.	This value is optional and can be left blank if no information is provided.
ordering_provider_first_name (OTC)	ORC-12.3	No	Yes	Enter the first name of the ordering provider.	File will fail if field left blank.
ordering_provider_street (OTC)	ORC-24.1	Requested	Yes	Enter the street address of the ordering provider.	File will fail if field left blank.
ordering_provider_street2 (OTC)	ORC-24.2	No	No	**Optional:** Enter ordering provider's additional address information, if applicable.	This value is optional and can be left blank if no information is provided.
ordering_provider_city (OTC)	ORC-24.3	Requested	Yes	Enter ordering provider's city.	File will fail if field left blank.
ordering_provider_state (OTC)	ORC-24.4	Requested	Yes	Enter ordering provider's state using the two-character abbreviation.	File will fail if field left blank.
ordering_provider_zip_code (OTC)	ORC-24.5	Requested	Yes	Enter ordering provider zip code. **Accepted Format:** 12345 12345-6789	File will fail if value is not entered using accepted format or field is left blank.

ordering_provider_phone_number (OTC)	ORC-14.7	Requested	Yes - Conditional	Enter ordering provider's phone number. **Accepted Format:** 000-000-000	File will fail if value is not entered using accepted format or field is left blank.

Testing Facility Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
testing_lab_clia (OTC)	OBX-23.10	Yes	Yes	Enter testing facility's CLIA number.	File will fail if left blank. CLIA numbers can be found at https://www.cdc.gov/clia/LabSearch.html. For OTC, use 00Z0000014 For prescription, use 00Z0000015
testing_lab_name	OBX-23.1	No	Yes	Enter testing facility's name.	File will fail if field left blank.
testing_lab_street	OBX-24.1	No	Yes	Enter the street address of the testing facility.	File will fail if field left blank.
testing_lab_street 2	OBX-24.2	No	No	**Optional:** Enter testing facility's additional address information, if applicable.	This value is optional and can be left blank if no information is provided.
testing_lab_city	OBX-24.3	No	Yes	Enter testing facility's city.	File will fail if field left blank.
testing_lab_state	OBX-24.4	Yes	Yes	Enter testing facility's state using the two-character abbreviation.	File will fail if field left blank.
testing_lab_zip_code	OBX-24.5	Yes	Yes	Enter testing facility's zip code. **Accepted Format:** 12345 12345-6789	File will fail if value is not entered using accepted format or field is left blank.
testing_lab_phone_number	N/A	No	No	Enter testing lab's phone number, if known. **Accepted Format:** • 000-000-0000	File will fail if value is not entered using accepted format.

Ask-On-Entry (AOEs)

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
pregnant	OBX-3.1 OBX-5.1	Requested	Requested	**Optional - Requested:** Enter patient's pregnancy status. **OBX-3.1** 82810-3 **OBX-5.1** 77386006 (Yes) 60001007 (No) 261665006 (Unknown) **CSV** Y (Yes) N (No) U (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
employed_in_healthcare	OBX-3.1 OBX-5.1	Requested	Requested	**Optional - Requested:** Enter patient's employment in healthcare status. **OBX-3.1** 95418-0 **OBX-5.1/CSV** Y (Yes) N (No) U (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
symptomatic_for_disease (OTC)	OBX-3.1 OBX-5.1	Requested	Requested	**Optional - Requested:** Enter patient's symptomatic for disease status. **OBX-3.1** 95419-8 **OBX-5.1/CSV** Y (Yes) N (No) U (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
illness_onset_date (OTC)	OBX-3.1 OBX-5.1	Requested	Requested	Enter patient's illness onset date. **OBX-3.1** 65222-2 **OBX-5.1 Accepted Format:** yyyyMMdd	Field is not required, but requested for thorough reporting.

resident_congregate_setting	OBX-3.1 OBX-5.1	Requested	Requested	**Optional - Requested:** Enter patient's congregate housing status. **OBX-3.1** 95421-4 **OBX-5.1/CSV** Y (Yes) N (No) U (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
residence_type	N/A	Requested	Requested	**Optional - Requested:** Enter the type of facility providing care for patient. **Accepted Values:** 22232009 (Hospital) 2081004 (Hospital ship) 32074000 (Long Term Care Hospital) 224929004 (Secure Hospital) 42665001 (Nursing Home) 30629002 (Retirement Home) 74056004 (Orphanage) 722173008 (Prison-based care site) 20078004 (Substance Abuse Treatment Center) 257573002 (Boarding House) 224683003 (Military Accommodation) 284546000 (Hospice) 257628001 (Hostel) 310207003 (Sheltered Housing) 57656006 (Penal Institution) 285113009 (Religious institutional residence) 285141008 (Work environment) 32911000 (Homeless) 261665006 (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
hospitalized	OBX-3.1 OBX-5.1	Requested	Requested	**Optional - Requested:** Enter patient's hospitalization status. **OBX-3.1** 77974-4 **OBX-5.1/CSV** Y (Yes) N (No) U (Unknown)	Field is not required, but requested for thorough reporting. Enter one of the acceptable values exactly as displayed.
icu	OBX-3.1	Requested	Requested	**Optional - Requested:** Enter patient's intensive care unit (ICU)	Field is not required, but requested for thorough

	OBX-5.1			status. **OBX-3.1** 77974-4 **OBX-5.1/CSV** Y (Yes) N (No) U (Unknown)	reporting. Enter one of the acceptable values exactly as displayed.

Reporting and Ordering Facility Data Elements

All Reporting and Ordering Facility Data Elements can be left blank for CSV if same as Testing Facility Data Elements

CSV Column Names	HL7 Field / Component	Fed Required?	State Required?	Data Requirements	Additional Guidance
reporting_facility_name	MSH-4.1	Yes	Yes		Can be left blank for CSV if same as testing_lab_name.
reporting_facility_clia	MSH-4.2	Yes	Yes		Can be left blank for CSV if same as testing_lab_clia.
ordering_facility_name	ORC-21.1	No	Yes – Conditional	Enter ordering facility name.	Can be left blank for CSV if same as testing_lab_name.
ordering_facility_street	ORC-22.1	No	Yes – Conditional	Enter the street address of the ordering facility.	Can be left blank for CSV if same as testing_lab_street.
ordering_facility_street2	ORC-22.2	No	No	**Optional:** Enter ordering facility's additional address information, if applicable.	This value is optional and can be left blank if no information is provided.
ordering_facility_city	ORC-22.3	No	Yes – Conditional	Enter ordering facility's city.	Can be left blank for CSV if same as testing_lab_city.
ordering_facility_state	ORC-22.4	No	Yes – Conditional	Enter ordering facility's state using the two-character abbreviation.	Can be left blank for CSV if same as testing_lab_state.
ordering_facility_zip_code	ORC-22.5	No	Yes – Conditional	Enter ordering facility zip code. **Accepted Format:** • 12345 • 12345-6789	Can be left blank for CSV if same as testing_lab_zip_code.
ordering_facility_phone_number	ORC-23	No	Yes – Conditional	Enter ordering facility phone number. **Accepted Format:** 000-000-0000	Can be left blank for CSV if same as testing_lab_phone_number.

Appendix B: Sample Payloads and Output

Sample CSV Payload and Output

Input:

A sample file may be downloaded from https://reportstream.cdc.gov/assets/csv/ReportStream-StandardCSV-ExampleData-20220509.csv

Response:


```
{
  "id" : "dbfbb65f-f6f0-4d85-a723-32b63283f068",
  "submissionId" : 2412,
  "overallStatus" : "Waiting to Deliver",
  "timestamp" : "2022-05-16T14:39:02.159Z",
  "plannedCompletionAt" : "2022-05-16T14:40:00.000Z",
  "actualCompletionAt" : null,
  "sender" : "csvuploadertest.default",
  "reportItemCount" : 5,
  "errorCount" : 0,
  "warningCount" : 0,
  "httpStatus" : 201,
  "destinations" : [ {
    "organization" : "Alabama Public Health Department",
    "organization_id" : "al-phd",
    "service" : "elr",
    "itemCount" : 5,
    "itemCountBeforeQualityFiltering" : 5,
    "sending_at" : "2022-05-16T14:40:00.000Z",
    "filteredReportRows" : [ ],
    "filteredReportItems" : [ ],
    "sentReports" : [ ],
    "downloadedReports" : [ ]
  } ],
  "errors" : [ ],
  "warnings" : [ ],
  "topic" : "covid-19",
  "externalName" : null,
  "destinationCount" : 1
}
```

Sample HL7 2.5.1 Payload and Output

Input:

FHS|^~\&|CDC PRIME - Atlanta,^2.16.840.1.114222.4.1.237821^ISO|CDC PRIME - Atlanta,^2.16.840.1.114222.4.1.237821^ISO|||202108031315+0000
BHS|^~\&|CDC PRIME - Atlanta,^2.16.840.1.114222.4.1.237821^ISO|CDC PRIME - Atlanta,^2.16.840.1.114222.4.1.237821^ISO|||202108031315+0000
MSH|^~\&|CDC PRIME - Atlanta,^2.16.840.1.114222.4.1.237821^ISO|Winchester House^05D2222542^ISO|CDPH CA REDIE^2.16.840.1.114222.4.3.3.10.1.1^ISO|CDPH_CID^2.16.840.1.114222.4.1.214104^ISO|20210803131511.0147+0000||ORU^R01^ORU_R01|1234d1d1-95fe-462c-8ac6-46728dba581c|P|2.5.1|||NE|NE|USA|UNICODE UTF-8|||PHLabReport-NoAck^ELR_Receiver^2.16.840.1.113883.9.11^ISO
SFT|Centers for Disease Control and Prevention|0.1-SNAPSHOT|PRIME Data Hub|0.1-SNAPSHOT||202107260000
PID|1||09d12345-0987-1234-1234-111b1ee0879f^^^Winchester House&05D2222542&ISO^PI^&05D2222542&ISO||Bunny^Bugs^C^^^^L||19000101|M||2106-3^White^HL70005^^^^2.5.1|12345 Main St^^San Jose^CA^95125^USA^^^06085||(123)456-7890^PRN^PH^^1^123^4567890|||||||N^Non Hispanic or Latino^HL70189^^^^2.9|||||||N
ORC|RE|1234d1d1-95fe-462c-8ac6-46728dba581c^Winchester House^05D2222542^ISO|1234d1d1-95fe-462c-8ac6-46728dba581c^Winchester House^05D2222542^ISO|||||||1679892871^Doolittle^Doctor^^^^^^CMS&2.16.840.1.113883.3.249&ISO^^^^NPI||(123)456-7890^WPN^PH^^1^123^4567890|202108020000+0000||||||Winchester House|6789 Main St^^San Jose^CA^95126^^^^06085|(123)456-7890^WPN^PH^^1^123^4567890|6789 Main St^^San Jose^CA^95126
OBR|1|1234d1d1-95fe-462c-8ac6-46728dba581c^Winchester House^05D2222542^ISO|1234d1d1-95fe-462c-8ac6-46728dba581c^Winchester House^05D2222542^ISO|94558-4^SARS-CoV-2 (COVID-19) Ag [Presence] in Respiratory specimen by Rapid immunoassay^LN^^^^2.68|||202108020000-0500|202108020000-0500|||||||1679892871^Doolittle^Doctor^^^^^^CMS&2.16.840.1.113883.3.249&ISO^^^^NPI|(123)456-7890^WPN^PH^^1^123^4567890|||||202108020000-0500|||F
OBX|1|CWE|94558-4^SARS-CoV-2 (COVID-19) Ag [Presence] in Respiratory specimen by Rapid immunoassay^LN^^^^2.68||260415000^Not detected^SCT|||N^Normal (applies to non-numeric results)^HL70078^^^^2.7|||F|||202108020000-0500|05D2222542^ISO||BD Veritor System for Rapid Detection of SARS-CoV-2_Becton, Dickinson and Company (BD)^BD Veritor System for Rapid Detection of SARS-CoV-2^99ELR^^^^2.68^^BD Veritor System for Rapid Detection of SARS-CoV-2_Becton, Dickinson and Company (BD)_EUA||202108020000-0500||||Winchester House^^^^^ISO&2.16.840.1.113883.19.4.6&ISO^XX^^^05D2222542|6789 Main St^^San Jose^CA^95126^^^^06085
OBX|2|CWE|95418-0^Whether patient is employed in a healthcare setting^LN^^^^2.69||N^No^HL70136||||||F|||202108020000-0500|05D2222542||||202108020000-0500||||Winchester House^^^^^ISO&2.16.840.1.113883.19.4.6&ISO^XX^^^05D2222542|6789 Main St^^San Jose^CA^95126-5285^^^^06085|||||QST
OBX|3|CWE|95417-2^First test for condition of interest^LN^^^^2.69||N^No^HL70136||||||F|||202108020000-0500|05D2222542||||202108020000-0500||||Winchester House^^^^^ISO&2.16.840.1.113883.19.4.6&ISO^XX^^^05D2222542|6789 Main St^^San Jose^CA^95126-5285^^^^06085|||||QST
OBX|4|CWE|95421-4^Resides in a congregate care setting^LN^^^^2.69||Y^Yes^HL70136||||||F|||202108020000-0500|05D2222542||||202108020000-0500||||Winchester House^^^^^ISO&2.16.840.1.113883.19.4.6&ISO^XX^^^05D2222542|6789 Main St^^San Jose^CA^95126-5285^^^^06085|||||QST
OBX|5|CWE|95419-8^Has symptoms related to condition of interest^LN^^^^2.69||N^No^HL70136||||||F|||202108020000-0500|05D2222542||||202108020000-0500||||Winchester House^^^^^ISO&2.16.840.1.113883.19.4.6&ISO^XX^^^05D2222542|6789 Main St^^San Jose^CA^95126-5285^^^^06085|||||QST
SPM|1|1234d1d1-95fe-462c-8ac6-46728dba581c&&05D2222542&ISO^1234d1d1-95fe-462c-8ac6-46728dba581c&&05D2222542&ISO||445297001^Swab of internal nose^SCT^^^^2.67||||53342003^Internal nose structure (body structure)^SCT^^^^2020-09-01|||||||||202108020000-0500|20210802000006.0000-0500
BTS|1|
FTS|1|

Example HL7 file:

ReportStream Hl7 Example.hl7

Response:


```
{
  "id" : "f08ccba0-c5ff-4ef5-924c-f72747603f02",
  "timestamp" : "2021-08-05T11:33:01.060209Z",
  "topic" : "covid-19",
  "reportItemCount" : 1,
  "destinations" : [ {
    "organization" : "California Department of Public Health",
    "organization_id" : "ca-dph",
    "service" : "elr",
    "sending_at" : "2021-08-05T07:34-04:00",
    "itemCount" : 1
  } ],
  "destinationCount" : 1,
  "warningCount" : 0,
  "errorCount" : 0,
  "errors" : [ ],
  "warnings" : [ ]
}
```

Appendix C: ReportStream Data Models

While ReportStream's initial uses have focused on COVID-19 test results, it's designed to accept a wide variety of healthcare data in CSV or HL7 2.5.1 format.

During the onboarding process, the ReportStream team configures a data model or schema associated with your client-id. When ReportStream receives a submission, its data gets validated against that schema prior to ingesting, transforming, and routing the data.

If you send us non-PII sample/example data, we can work with you to develop a schema meeting your needs. Or you can send data meeting one of our existing schemas.

Examples

COVID-19 data matching HHS Guidance: https://github.com/CDCgov/prime-reportstream/blob/master/prime-router/docs/schema_documentation/direct-direct-covid-19.md

A simple schema meant for testing and demos: https://github.com/CDCgov/prime-reportstream/blob/master/prime-router/docs/schema_documentation/sample-phd1-sample.md

A complex real-life schema used by our sister project, SimpleReport, for submitting COVID-19 data: https://github.com/CDCgov/prime-reportstream/blob/master/prime-router/docs/schema_documentation/primedatainput-pdi-covid-19.md

Other examples of COVID-19 schemas: https://github.com/CDCgov/prime-

reportstream/tree/master/prime-router/docs/schema_documentation

Additional Resources

COVID-19 Diagnostic Data Standards: Frequently Asked Questions