# Patient-Import 3.x

Setup Guide for Transplant Center Partners

*(Rev: June 2024)*

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# Welcome!

## Patient-Import Overview

**Patient-Import** is an application that allows automated patient record creation and updates and sits in front of NMDP's ***Match****Source*® application. By providing a public application programming interface (API), transplant centers and partners can push data from their own healthcare systems (EPIC, CERNER, etc.) to ***Match****Source*® rather than requiring users to manually copy patient fields from one system to another. This is much more efficient and decreases the chance of transposition errors.

### Architecture

The public Patient-Import APIs are based on industry standards. The services expect a RESTful call over HTTPS (SSL/TLS) using the JSON data format. The message payload is based on the HL7® FHIR® healthcare standard (https://fhir.org/) for modeling patient data. Patient-Import has a FHIR Implementation Guide (IG) that can be referenced here: https://fhir.nmdp.org/ig/matchsync/index.html

A successful call to the synchronous "create" endpoint results in a response containing the patient record "RID" (*recipient identifier*, aka "NMDP ID") that was generated. The RID can be stored in the caller's system and is one way ***Match****Source*® users can lookup patients.

A successful call to the synchronous "update" endpoint results in one or more fields being automatically modified for the patient record in NMDP systems.

### Work Effort

Each Transplant Center (TC) or partner utilizing Patient-Import for patient creation/updates is free to incorporate the functions in a manner that benefits their own patient workflow. The process of mapping patient data and integrating with business process triggers is specific to each Transplant Center. For instance, one partner has built an automated system trigger to push patient records to NMDP upon receiving a BMT referral. Another has built a push-button mechanism into their healthcare system to import a patient record to ***Match****Source*® manually. Because of the differences in data storage, EHR system used, and desired trigger to send data, the overall effort required to integrate with Patient-Import is unique for each TC. NMDP can provide details on past partnerships and help with scope and estimation for your organization.

## Security

Patient-Import service calls are secured using JWT bearer tokens in the message header. The short-life token is obtained by the caller through a request to NMDP's identity provider. Under the oversight of the U.S. Federal Government, Department of Health and Human Services, NMDP products must comply with federal FISMA system requirements, including NIST 800-53 technical security specifications, and the technical specifications of the corresponding Authentication Assurance Level (see NIST 800-63).

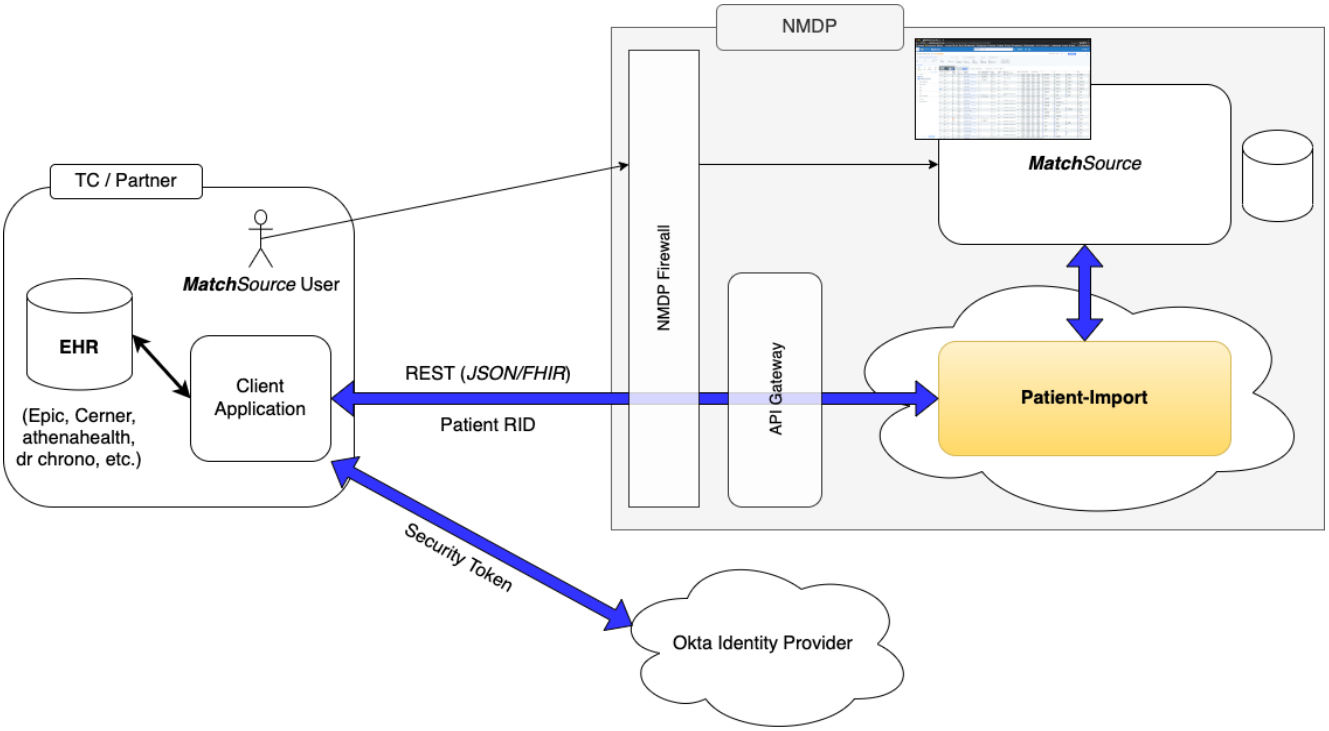
Details around Patient-Import security are discussed in the next section of this document and the NMDP security team can answer questions and address concerns as needed.

## Delivery Approach

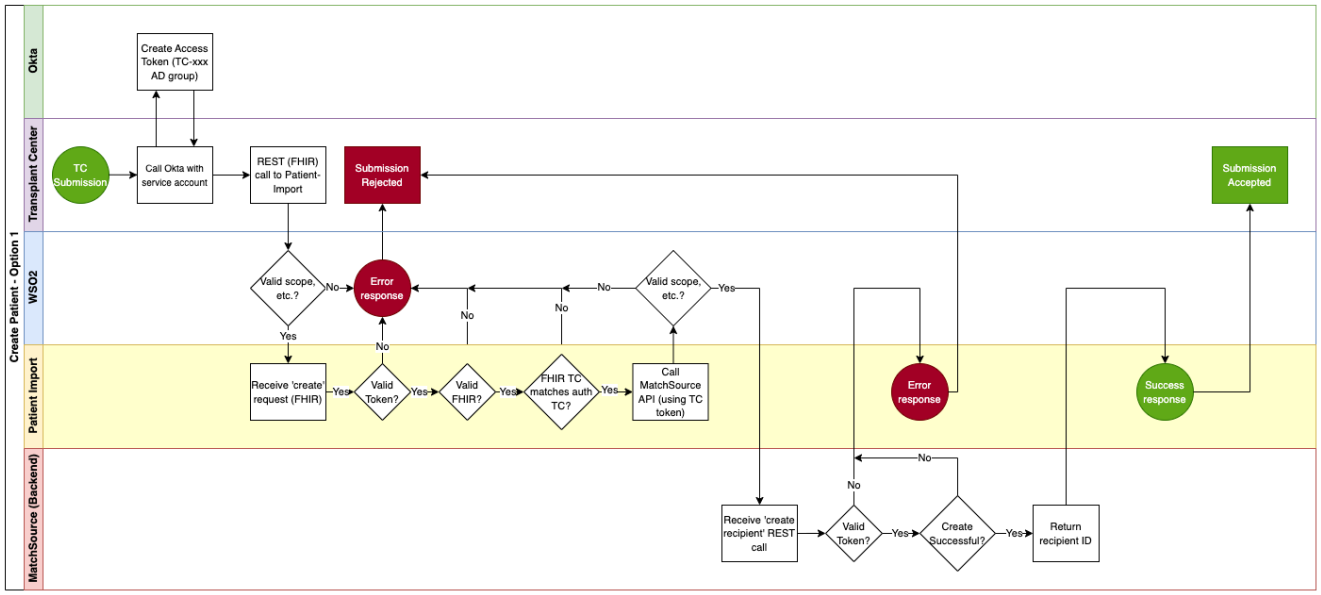
Patient-Import is exposed to our partners in a "lower" pre-production environment as well as in production. Partners may test the automation process, connections, and data integration in the lower environment. When ready, the move to production is trivial.

The NMDP delivery team works closely with partners to address issues and help troubleshoot.

## Overview Diagram




## Patient Import Flow Diagram



# Security Call

The authentication and authorization processes protecting Patient-Import require partners to obtain a security token which is then included with the service call.

NMDP uses Okta as an identity provider; a call to Okta returns a bearer token (JWT). *Each transplant-center/partner* is issued a unique service account and password. Generated security tokens are good for **30 minutes** before expiring. It is recommended that each call to Patient-Import generate a new security token to avoid needing to manage tokens or accidentally using an expired token.

## Request Parameters

There are five parameters required to obtain a bearer token:

1. The service account [**l1_*xxx*_api_user**] *(lower env)*
2. The service account password [<account-password>]
3. The application client ID [**0oa1clbzsjjzpYTcM0h8**] *(lower env)*
4. The application client Secret [<client-secret>]
5. The scope(s) needed [**int_matchsync_patient_import**] *(lower env)*

Note: For production, the service account name, password, and scope details will need to be updated to production values. The NMDP support team will provide these details when you are ready.

The Okta/identity provider URL for lower environment tokens is:
https://nmdp.oktapreview.com/oauth2/ausaexcazhLhxKnJs0h7/v1/token

The Okta/identity provider URL for production tokens is:
https://nmdp.okta.com/oauth2/aus3ck6q30qmOdpMb1t7/v1/token

## Examples

The call to Okta can be tested with tools like Postman or command-line tools like ***cUrl*** as shown below:

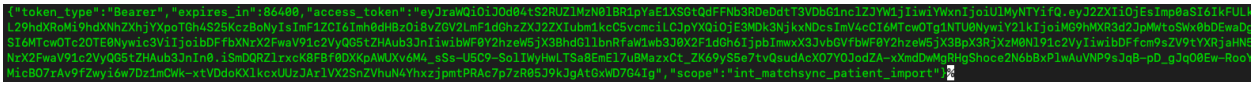
```
$ curl --location --request POST '<okta-endpoint>' \
--header 'Content-Type: application/x-www-form-urlencoded' \
--header 'Authorization: Basic <<base64 encoding of
<<clientID>>:<<clientSecret>>>>'  \
--data-urlencode 'grant_type=password' \
--data-urlencode 'username=<<ServiceAccountUserID>>' \
--data-urlencode 'scope=<<Scope>>' \
--data-urlencode 'password=<<ServiceAccountPassword>>'
```

Here is what a lower environment call using one of our partner's service accounts looks like:

```
$ curl --location --request POST
'https://nmdp.oktapreview.com/oauth2/ausaexcazhLhxKnJs0h7/v1/token' \
```

```
--header 'Content-Type: application/x-www-form-urlencoded' \
--header 'Authorization: Basic
MG9hMWNsYnpzamp6cFlUY0<...HIDDEN...>qTTFlWkQxTXRfU2dqd0Y5amRFYQ==
' \
--data-urlencode 'grant_type=password' \
--data-urlencode 'username=l1_msk_api_user' \
--data-urlencode 'password=<password>' \
--data-urlencode 'scope=int_matchsync_patient_import'
```

A sample token response looks like this:




When the JWT token is decoded, the contents of the payload are similar to this:

PAYLOAD: DATA


```
{
  "ver": 1,
  "jti":
"AT.1WafRJEQqoZt6pBQdV_GnfgDOLbvKkfLQLAxs_yngd4",
  "iss":
"https://nmdp.oktapreview.com/oauth2/ausaexcazhLhxKnJs0h
7",
  "aud": "https://dev.authserver.nmdp.org",
  "iat": 1709768766,
  "exp": 1709855166,
  "cid": "0oa1twwbi1khIltl10h8",
  "uid": "00u1fh6aaleEPDRlJ0h8",
  "scp": [
    "int_matchsync_patient_import"
  ],
  "auth_time": 1709768766,
  "sub": "l1_msk_api_user@nmdp.org",
  "matchsync_patient_import_authz": [
    "l1_role_matchsync_pi_tc_346_user",
    "l1_role_matchsync_pi_tc_347_user"
  ],
  "last_name": "_msk_api_user",
  "first_name": "l1",
  "email": "l1_msk_api_user@nmdp.org"
}
```

# Patient-Import Service Calls

Once you have a valid security token from the previous section, you are authenticated and authorized to send patient “create” and “update” requests from your transplant center.

The call to Patient-Import is a standard RESTful call over HTTPS. The payload content-type is JSON (*application/json*) and an “Authorization” security header for your Bearer token must be present. The format of the JSON payload is modeled on the HL7® FHIR® healthcare standard.

The *patient-create* service call uses the HTTP method, “**POST”**. The *patient-update* service call uses the HTTP method, “**PUT**”.

## API Versions

Patient-Import hosts multiple versions of each service endpoint. Partners can choose which version best meets their needs and can decide when it makes sense to upgrade to a newer version. Incremental changes to an established version shall be non-breaking and backward compatible while new major releases (1.0, 2.0, 3.0) represent new structures or features that may require some work to upgrade.

As of April 2024, Patient-Import supports two major releases, 2.0 and 3.0. *It is highly recommended* to always target the latest API version as older versions won’t have the latest features and may be deprecated as newer versions are released.

Hosted specifications (lower environment):

Version 2.0

- Swagger: https://int-api.nmdp.org/int-matchsource-patient-import/2.0/swagger-ui/index.html
- API spec: https://int-api.nmdp.org/int-matchsource-patient-import/2.0/api-docs

**Version 3.0**

- **Swagger**: https://int-api.nmdp.org/int-matchsync-patient-import/3.0/swagger-ui/index.html
- **API spec**: https://int-api.nmdp.org/int-matchsync-patient-import/3.0/api-docs
- **Sample Payload**: https://int-api.nmdp.org/int-matchsync-patient-import/3.0/example/patient-payload-example.json
- **FHIR IG**: https://fhir.nmdp.org/ig/matchsync/index.html

## The “Create” Endpoint

The *create* endpoint is called to automatically generate an NMDP patient record in ***Match****Source*®. A successful call will create a patient record with required fields and optional demographic information, disease information, and HLA typing (yes, you can submit your patient HLA this way!).

New ***Match****Source*® patient records are classified as “in-progress” if not all information is included up front. If all information, including HLA, is included in the initial submission, the record is upgraded to “preliminary” which will automatically kick off a donor search and provide search results in ***Match****Source*®.

### Form 117

If you submit HLA as part of this *create* call, it can satisfy the Form 117 high resolution reporting requirement. If you choose not to submit HLA to NMDP using this service, you can still depend on the existing lab/HLA intake process that assigns HLA typing data later. Note that the patient record must contain high resolution typing at HLA-A, HLA-B, HLA-C, HLA-DRB1, HLA-DPB1 and not contain serology results or any “:XX” allele codes to meet Form 117 requirements. New fields for typing date and a flag/code to certify the results as meeting Form 117 requirements have been added to the specification snippet below.

### HTTP Request Method

| | |
|---|---|
| URL (*production*) | https://api.nmdp.org/p-matchsync-patient-import/3.0/**patient** |
| URL (*lower/test*) | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/**patient** |
| Method | POST |

### HTTP Headers

| | |
|---|---|
| Content-Type | application/json |
| Authorization | Bearer <*security-token*> |

### Message Body/Patient Data

The message body is a JSON-formatted payload following the HL7/FHIR specification for modeling patient data, data fields, and value sets. For more information, see https://fhir.org/ as well as some NMDP standards for FHIR as part of our implementation guide (IG): https://fhir.nmdp.org/ig/matchsync/

The payload includes references to your NMDP-assigned transplant center identifier. All references to *transplant center* or *partner* in the payload must match the transplant center used to authenticate. For instance, if you authenticate using a service account for transplant center “123”, references throughout the FHIR payload must also use “TC 123”, otherwise a security error will be returned. This helps to prevent one partner from inadvertently submitting data for a different transplant center.

## *Required Fields*

The Patient-Import APIs require the minimum fields necessary to create a patient record in ***Match****Source*®. Note that this is *not* necessarily enough information to execute a search in MatchSource or return search results (additional optional fields, including HLA, are needed for a preliminary search).

Patient-Import API supports all fields necessary to perform a search, including HLA, however transplant centers can still take advantage of existing NMDP processes for receiving HLA typing data from labs separately. In this case, the Patient-Import API can be used to submit all required and optional demographic fields, but then rely on HLA to be received later from the labs. Once HLA arrives, an in-progress patient in MatchSource will automatically have HLA typing assigned and will execute a preliminary search.

### Required for In-Progress

This is the bare minimum needed to successfully generate an NMDP patient record. It is not enough information to run a donor search.

| Element | Notes | Field Type (in-progress) |
|---|---|---|
| **TC ID** | Provided by authentication of the API | **Required** |
| **Patient first name** | Text string, 40* Char | **Required** |
| **Patient Last name** | Text string, 40* Char | **Required** |
| **DOB** | YYYY-MM-DD | **Required** |
| **Local ID**** | Text string (TC EHR identifier) | Recommended |
| **Sex** | Enumerated list | **Required** |
| **Race** | Enumerated list | Required (*defaulted*) |
| **Ethnicity** | Enumerated list | Required (*defaulted*) |

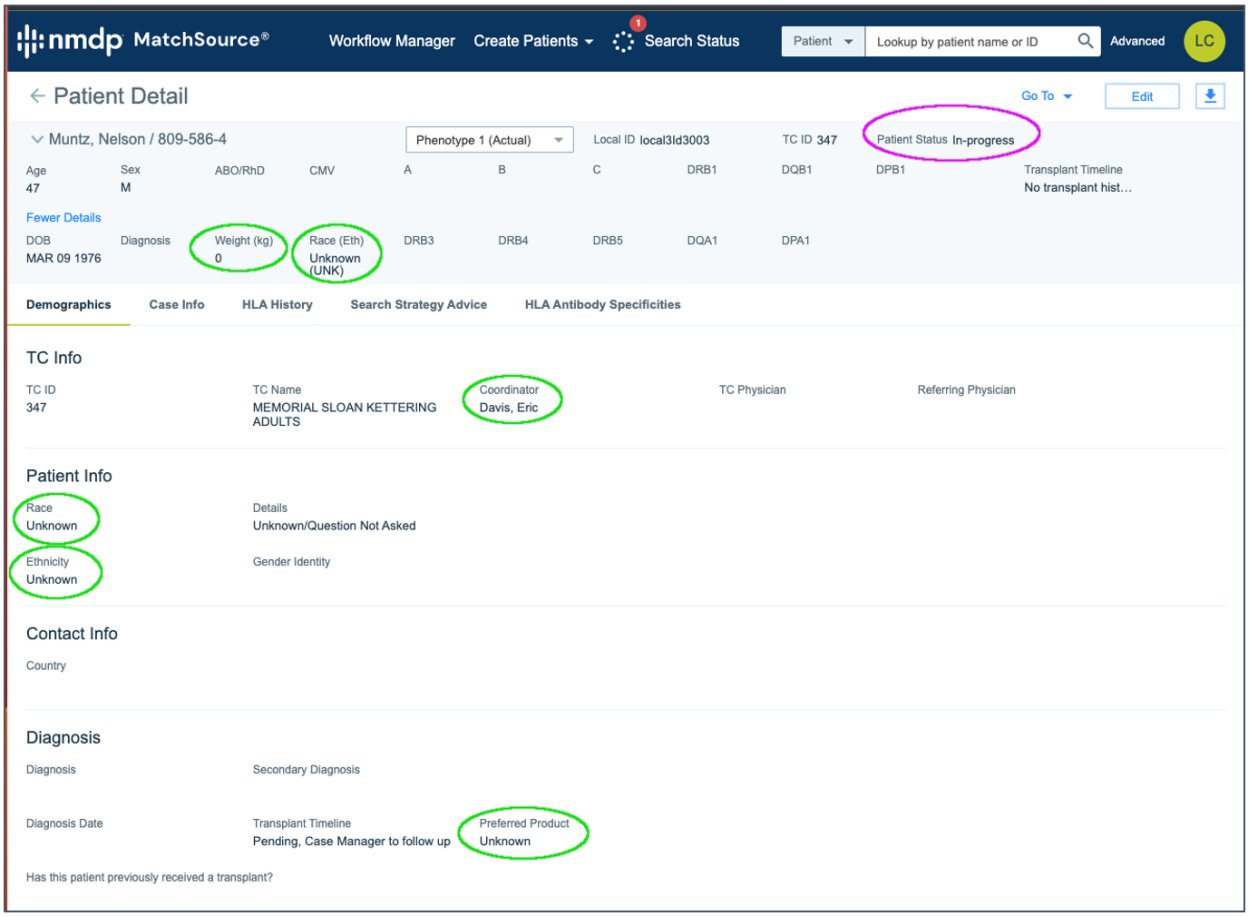
* *NMDP will be expanding these fields to 40 characters in 2024*

** *While not strictly required, this is how most transplant centers map a patient ID in their EHR system to an NMDP patient record so it is highly recommended that this value is always populated*

See the first sample payload shown in the **Addendum** at the end of this document for details of what data was sent for this example. It only includes patient name, birthdate, local-id, sex, and transplant center identifier.

This successful response includes the NMDP ID (RID) for the created record.

When viewed in ***Match***Source®, this minimum-data *create* call produces the following record:




Be aware that if not included, some fields are defaulted. The fields shown in **green** above are some examples of defaulted fields, which include weight, race, ethnicity, TC coordinator, etc.
Also note (**magenta**), the status of this patient record is “In-Progress” which represents a partial record and does not include enough information to be able to kick off a donor search.

## Required for Preliminary Search

These are the fields needed to both create a new patient record *and* generate a donor search in ***Match****Source*®. If successful, records created with the fields below will show status "PRLM".

| Element | Notes | Field Type (PRLM) |
|---|---|---|
| **TC ID** | Provided by authentication of the API | **Required** |
| Secondary Code | TC org abbreviation | Optional |
| TC coordinator | From enumerated list (***Match****Source*®) | Required (*defaulted*) |
| TC Physician: FN LN | Text string, 40 char | Optional |
| Referring Physician: FN LN | Text string, 40 char | Optional |
| **Patient first name** | Text string, 40* char | **Required** |
| **Patient Last name** | Text string, 40* char | **Required** |
| **DOB** | YYYY-MM-DD | **Required** |
| **Local ID** | Text string (TC EHR identifier), 50 char | **Required** |
| ITL/RefID for lab | ITL - Lab HLA reference id, 50 char | Optional (**required** for traditional HLA intake) |
| **Sex** | Enumerated list | **Required** |
| Weight | Positive integer (kg) | Optional (*defaulted*) |
| **Race** | Enumerated list | **Required** (*defaulted*) |
| **Ethnicity** | Enumerated list | **Required** (*defaulted*) |
| ABO (blood type) | Enumerated list | Optional |
| RH factor | Enumerated list | Optional |
| CMV | Enumerated list | Optional |
| **Country** | Enumerated list | **Required** |
| Street Address | Only if Country is US | Required (if US) |
| City | | Required (if US) |
| State | Enumerated list | Required (if US) |
| Zip | Not validated | Required (if US) |
| Phone | 10 char | Required (if US, *defaulted*) |
| Email | 55 char max | Optional |
| Preferred Language | Enumerated list | Required (if US, *defaulted*) |
| **Diagnosis** | Enumerated list | **Required** |
| **Diagnosis Date** | | **Required** |
| Secondary Diagnosis | | Conditionally Required |
| Disease Stage | Enumerated list | Conditionally Required, *defaulted* |
| Number of Remissions | | Optional (*defaulted*) |
| Transplant Timeline | Enumerated list | Required (*defaulted*) |

| Preferred Product | Enumerated list | Required (*defaulted*) |
|---|---|---|
| HLA-A† | | Required to Search |
| HLA-B† | | Required to Search |
| HLA-C | | Optional to Search |
| HLA-DRB1† | | Required to Search |
| HLA-DQB1 | | Optional to Search |
| HLA-DPB1 | | Optional to Search |
| HLA-DRB3 | | Optional to Search |
| HLA-DRB4 | | Optional to Search |
| HLA-DRB5 | | Optional to Search |
| HLA-DQA1 | | Optional to Search |
| HLA-DPA1 | | Optional to Search |

† *Minimum required HLA to perform a donor search*

* *NMDP will be expanding these fields to 40 characters in 2024*

Setup data for the enumerated fields (e.g. diagnosis) will be supplied by the Patient-Import delivery team. This is one of the first topics covered when meeting with new users to go over the value sets expected in ***Match****Source*®, how they are modeled in FHIR (and the value code system where applicable), and what mappings might be needed.

## The “Update” Endpoint

The *update* endpoint is called to modify an existing NMDP patient record in ***Match****Source*®. A successful call will cause one or more fields to be updated including demographic information, disease information, and HLA typing. Any patient record can be updated using this API endpoint, not just patient records created through Patient-Import.

***Match****Source*® patient records are classified as “in-progress” if not enough data is included to be able to run a donor search. If all information, including HLA, is present following an *update*, the record is upgraded to “preliminary” which will automatically kick off a donor search and display search results in ***Match****Source*®.

### Form 117

If you submit HLA as part of an *update* call, it can satisfy the Form 117 high resolution reporting requirement. By sending a typing date and a value certifying your HLA meets Form 117 high resolution requirements, you need not submit a Form 117 separately. Note that the patient record must contain high resolution typing at HLA-A, HLA-B, HLA-C, HLA-DRB1, HLA-DPB1 and not contain serology results or any “:XX” allele codes to be considered for Form 117 compliance. New fields for typing date and a flag/code to certify the results as meeting Form 117 requirements have been added to the specification snippet below.

### Identifying a Record

When an “update” is performed, the target record is identified by three pieces of data:

- Transplant **center code** (3-digit number assigned by NMDP) – to be included in the payload and as part of the bearer token used to authenticate
- Patient **RID** (NMDP recipient ID) – the 7-digit RID returned by the “create” endpoint (or as displayed in ***Match****Source*®)
- Patient **date-of-birth** – sent as an extra check to make sure the RID submitted is the correct target patient

### Removing Data from a Record

Existing data in optional fields can be removed by passing *null*. Exceptions to this are ABO, RhD, CMV and phone number which can be replaced but cannot be removed once set. See the “Nullable” column under “*Required Fields*” below.

### HTTP Request Method

| | |
|---|---|
| URL (*production*) | https://api.nmdp.org/p-matchsync-patient-import/3.0/**patient/{RID}** |
| URL (*lower/test*) | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/**patient/{RID}** |
| Method | PUT |

### HTTP Headers

| | |
|---|---|
| Content-Type | application/json |
| Authorization | Bearer *<security-token>* |

## Message Body/Patient Data

The “update” feature uses the same FHIR structure and field definitions as the “create” endpoint.

The message body is a JSON-formatted payload following the HL7/FHIR specification for modeling patient data, data fields, and value sets. For more information, see https://fhir.org/ as well as some NMDP standards for FHIR as part of our implementation guide (IG): https://fhir.nmdp.org/ig/matchsync/

The payload includes references to your NMDP-assigned transplant center identifier. All references to *transplant center* or *partner* in the payload must match the transplant center used to authenticate. For instance, if you authenticate using a service account for transplant center 123, references throughout the FHIR payload must also use “TC 123”, otherwise a security error will be returned. This helps to prevent one partner from inadvertently submitting data for a different transplant center.

### Required Fields

Following an “*update*” call, the resulting patient record is validated against the list of required fields and enumerated field values. If the list of required fields is not met, the update operation fails.

For a list of required fields enforced when updating an “in-progress” record, see the earlier *Required for In-Progress* section of this document under the “*create*” API.

For records being updated as “preliminary”, the below fields are considered required.

| Element | Notes | Nullable? | Field Type (PRLM) |
|---|---|---|---|
| **TC ID** | Provided by authentication of the API | N | **Required** |
| Secondary Code | TC org abbreviation | Y | Optional |
| TC Coordinator | From enumerated list (***Match****Source*®) | (Default: first) | **Required** (*defaulted*) |
| TC Physician: FN LN | Text string, 40 char | Y | Optional |
| Referring Physician: FN LN | Text string, 40 char | Y | Optional |
| **Patient first name** | Text string, 40* Char | N | **Required** |
| **Patient Last name** | Text string, 40* Char | N | **Required** |
| **DOB** | YYYY-MM-DD | N | **Required** |
| **Local ID** | Text string (TC EHR identifier), 50 char | | **Required** |
| ITL/RefID for lab | ITL - Lab HLA reference id, 50 char | Y | Optional (**required** for traditional HLA intake) |
| **Sex** | Enumerated list | N | **Required** |
| Weight | Positive integer (kg) | Y (Default: 0) | Optional (defaulted) |

| | | | |
|---|---|---|---|
| **Race** | Enumerated list | (Default: "Unknown") | **Required** (defaulted) |
| **Ethnicity** | Enumerated list | (Default: "Unknown") | **Required** (defaulted) |
| ABO (blood type) | Enumerated list | N | Optional |
| RH factor | Enumerated list | N | Optional |
| CMV | Enumerated list | N | Optional |
| **Country** | Enumerated list | N | **Required** |
| Street Address | Only if Country is US | N | Required (if US) |
| City | | N | Required (if US) |
| State | Enumerated list | N | Required (if US) |
| Zip | Not validated | N | Required (if US) |
| Phone | 10 char | N | Required (if US) |
| Email | 55 char max | Y | Optional |
| Preferred Language | Enumerated list | (Default: "English") | **Required** (defaulted) |
| **Diagnosis** | Enumerated list | N | **Required** (ICD-10 mapping) |
| **Diagnosis Date** | | N | **Required** |
| Secondary Diagnosis | | | Conditionally Required |
| Disease Stage | Enumerated list | | |
| Number of Remissions | | (Default: "99") | Optional (defaulted) |
| Transplant Timeline | Enumerated list | (Default: "Pending") | **Required** (defaulted) |
| Preferred Product | | (Default: "Unknown") | **Required** (defaulted) |
| HLA-A† | | N | Required to Search |
| HLA-B† | | N | Required to Search |
| HLA-C | | | Optional to Search |
| HLA-DRB1† | | N | Required to Search |
| HLA-DQB1 | | | Optional to Search |
| HLA-DPB1 | | | Optional to Search |
| HLA-DRB3 | | | Optional to Search |
| HLA-DRB4 | | | Optional to Search |
| HLA-DRB5 | | | Optional to Search |
| HLA-DQA1 | | | Optional to Search |
| HLA-DPA1 | | | Optional to Search |

† *Minimum required to perform a donor search*

* *NMDP will be expanding these fields to 40 characters in 2024*

## The “Health” Endpoint

The *health* endpoint is used to determine if the Patient-Import application is available to create or modify patient records. It can be used as a “heartbeat” endpoint by transplant centers and partners. The Patient-Import application has a target of 99.9% ("three nines") availability and is expected to always be available during business hours, 7 am to 8 pm US central time, Monday through Friday.

NMDP has maintenance windows, security patching, and other activities that will cause Patient-Import or its dependent systems to be down from time to time, for example after 9 PM central time on certain Fridays. This *health* endpoint may optionally be used to verify the status of Patient-Import before sending a patient *create* or *update* request.

An HTTP 200/OK response means Patient-Import and ***Match****Source*® are available and healthy. Any other response should be interpreted as Patient-Import being unable to process new requests. In the event of a failure, try again in a few minutes.
**This call does not require a security token or header.**

### How to Use

Two ways this endpoint can be used are *on-demand* and as part of a health check *polling loop*. The on-demand approach would be suitable for a system where patient records are manually submitted to NMDP and could determine whether a trigger or submission button is enabled or disabled. A polling loop would work well with a fully automated system where the client periodically checks the health of Patient-Import (e.g. every 60 seconds) and queues submissions until a success response is returned.

### HTTP Request Method

| | |
|---|---|
| URL (*production*) | https://api.nmdp.org/p-matchsync-patient-import/3.0/health |
| URL (*lower/test*) | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/health |
| Method | GET |

### HTTP Headers

| | |
|---|---|
| N/A | (*No security token required*) |

### HTTP Response

| | | | |
|---|---|---|---|
| Success / Ready | HTTP 200/OK | application/json | {<br>"status": "UP"<br>} |
| Patient-Import systems unable to process requests | HTTP 500/Internal Server Error | application/json | {<br>"status": "DOWN"<br>} |
| Patient-Import down or unavailable | HTTP 404/Not Found<br>HTTP 401/Unauthorized | | |

## Throttling

For added security and to guard against accidental large volumes of submissions hitting the Patient-Import create/update endpoints, each transplant center and partner is limited to **10 calls** within a **5-minute** period.

Note that the "*/health*" endpoint is not included in this limit.

If you believe your institution will exceed this limit, please contact the support team.

A sample payload is publicly available and hosted by NMDP at: https://int-api.nmdp.org/int-matchsync-patient-import/3.0/example/patient-payload-example.json

The FHIR implementation guide can be found here: https://fhir.nmdp.org/ig/matchsync/artifacts.html

The following is a detailed look at the FHIR payload structure and a few specific examples. Patient-Import only expects **one** patient record per submission in the FHIR bundle.

## FHIR Bundle Structure

```
{
  "resourceType": "Bundle",
  "meta": {
    "profile": ["http://fhir.nmdp.org/ig/matchsource/StructureDefinition/msbundle"],
    "security": [
      {
        "system": "http://terminology.nmdp.org/codesystem/transplant-center",
        "code": "tc_123"
      }
    ]
  },
  "type": "collection",
  "timestamp": "2020-11-24T23:50:50-05:00",
  "entry": [
    {
      "fullUrl": "urn:uuid:cc111e78-15eb-430d-b337-a4418494bedc",
      "resource": {…}
    },
    {
      "fullUrl": "urn:uuid:cef4702d-cbe1-447b-b671-588dbfb40bb5",
      "resource": {…}
    },
    {
      "fullUrl": "urn:uuid:8fd0ef20-d146-4fff-b2a8-1d607adf9802",
      "resource": {…}
    },
    {
      "fullUrl": "urn:uuid:8fd0ef20-d146-4fff-b2a8-1d607adf9802",
      "resource": {…}
    },
    {
      "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f1",
      "resource": {…}
    },
...
    {
      "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62fe",
      "resource": {…}
    }
  ]
}
```

The 3-digit transplant center code (in yellow) is unique to your organization.

## Patient Info Fields

Patient Entry
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-mspatient.html


```
{
    "fullUrl": "urn:uuid:cc111e78-15eb-430d-b337-a4418494bedc",
    "resource": {
        "resourceType": "Patient",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/mspatient"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "name": [
            {
                "family": "Muntz",
                "given": [
                    "Nelson",
                    "B"
                ]
            }
        ],
        "gender": "male",
        "birthDate": "1976-03-09",
        "telecom": [
            {
                "system": "phone",
                "value": "1-612-555-1234"
            },
            {
                "system": "email",
                "value": "abc@tc.hospital.org"
            }
        ],
        "address": [
            {
                "line": [
                    "123 Main St"
                ],
                "city": "Minneapolis",
                "state": "MN",
                "postalCode": "55401",
                "country": "US"
            }
        ],
        "identifier": [
            {
                "use": "usual",
                "system": "http://terminology.nmdp.org/identifier/local-123",
                "value": "local3EpicId3003"
            }
        ],
        "communication": [
            {
                "language": {
                    "coding": [
                        {
                            "system": "urn:ietf:bcp:47",
                            "code": "ENG",
                            "display": "English"
                        }
                    ]
                },
                "preferred": true
            }
```

```
        ],
        "managingOrganization": {
            "reference": "urn:uuid:413d5929-1fc5-43a4-ad48-e7ffe6af768c"
        }
    }
}
```

## Lab Reference ID Field

LabRefId – This entry can be omitted if HLA is included in the Patient-Import *create* or *update* payloads. If not, this lab reference value is used to map HLA lab results to a patient record at a later time.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-msspecimen.html

```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f1",
    "resource": {
        "resourceType": "Specimen",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/msspecimen"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "identifier": [
            {
                "use": "usual",
                "system": "http://terminology.nmdp.org/identifier/lab-123",
                "value": "labRef21Id123"
            }
        ],
        "subject": {
            "reference": "urn:uuid:cc111e78-15eb-430d-b337-a4418494bedc"
        }
    }
}
```

## Disease/Diagnosis Fields

Fields to report the disease/diagnosis, secondary diagnosis, disease stage, and remissions. Disease codes are based on **ICD-10 codes** and mapped by NMDP to the correct enumerated fields in ***Match****Source*®.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-msdiagnosis.html
https://fhir.nmdp.org/ig/matchsync/CodeSystem-nmdp-disease-cs.html

```
{
    "fullUrl": "urn:uuid:be7873b5-9685-42a9-9815-6d048e6dcc8f",
    "resource": {
        "resourceType": "Condition",
        "id": "MSDiagnosisExample-AML",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/msdiagnosis"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "extension": [
            {
```

```
                "url": "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/number-of-
remissions",
                "valueInteger": 0
            }
        ],
        "code": {
            "coding": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/disease",
                    "code": "AML",
                    "display": "ACUTE MYELOGENOUS LEUKEMIA"
                }
            ]
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "recordedDate": "2021-11-01",
        "stage": [
            {
                "summary": {
                    "coding": [
                        {
                            "system": "http://terminology.nmdp.org/codesystem/diseasestage",
                            "code": "RM",
                            "display": "Remission"
                        }
                    ]
                }
            }
        ]
    }
}
```

## Patient Weight Field

Field to report patient weight, in kilograms.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-ms-weight-observation.html

```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f0",
    "resource": {
        "resourceType": "Observation",
        "id": "MSWeightObsExample",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/ms-weight-observation"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "status": "final",
        "category": [
            {
                "coding": [
                    {
                        "system": "http://terminology.hl7.org/CodeSystem/observation-category",
                        "code": "vital-signs"
                    }
                ]
            }
        ],
        "code": {
            "coding": [
                {
                    "system": "http://loinc.org",
```

```
                    "code": "29463-7",
                    "display": "Body weight"
                }
            ]
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "",
        "valueQuantity": {
            "value": 70,
            "unit": "Kg",
            "system": "",
            "code": ""
        }
    }
}
```

## Blood Type (ABO) Field

Field to report patient ABO.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-ms-abogroup-observation.html

```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f0",
    "resource": {
        "resourceType": "Observation",
        "id": "MSABOObsExample",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/ms-abogroup-
observation"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "status": "final",
        "code": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "85504-9",
                    "display": "Presumptive ABO group [Type] in Saliva (oral fluid) by Molecular
genetics method"
                }
            ]
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "",
        "valueCodeableConcept": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "LA19710-5",
                    "display": "Group A"
                }
            ]
        }
    }
}
```

## RhD Field

Field to report patient Rh value for blood type.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-ms-rhstatus-observation.html


```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f0",
    "resource": {
        "resourceType": "Observation",
        "id": "MSRhObsExample",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/ms-rhstatus-
observation"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "status": "final",
        "code": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "85505-6",
                    "display": "Presumptive ABO group [Type] in Saliva (oral fluid) by Molecular
genetics method"
                }
            ]
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "2022-05-01",
        "valueCodeableConcept": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "LA27326-0",
                    "display": "Rh+"
                }
            ]
        }
    }
}
```


## CMV Field

Field to report patient CMV status.


```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f0",
    "resource": {
        "resourceType": "Observation",
        "id": "CMV",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/cibmtr-reporting/StructureDefinition/cibmtr-obs-
priority-variables"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "status": "final",
```

```
        "code": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "13949-3",
                    "display": "Cytomegalovirus IgG Ab [Presence] in Serum or Plasma by
Immunoassay"
                }
            ]
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "2022-05-01",
        "valueCodeableConcept": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "LA6576-8",
                    "display": "Positive"
                }
            ]
        }
    }
}
```


## HLA-A Field

Field to report patient HLA for locus A.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-hla-a.html


```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f4",
    "resource": {
        "resourceType": "Observation",
        "id": "HLA-A",
        "meta": {
            "profile": [
                "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/hla-genotype"
            ],
            "security": [
                {
                    "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                    "code": "tc_123"
                }
            ]
        },
        "status": "final",
        "category": [
            {
                "coding": [
                    {
                        "system": "http://terminology.hl7.org/CodeSystem/observation-category",
                        "code": "laboratory"
                    }
                ]
            }
        ],
        "code": {
            "coding": [
                {
                    "system": "http://loinc.org",
                    "code": "84413-4"
                },
                {
                    "system": "http://loinc.org",
                    "code": "13298-5",
                    "display": "HLA-A [Type]"
                }
            ]
```

```
        },
        "subject": {
            "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "2022-05-01",
        "valueCodeableConcept": {
            "coding": [
                {
                    "system": "http://glstring.org",
                    "code": "hla#3.25.0#HLA-A*01:01:01:01+HLA-A*01:02"
                }
            ]
        },
        "specimen": {
            "reference": "Specimen/MSSpecimenExample"
        },
        "component": [
            {
                "code": {
                    "coding": [
                        {
                            "system": "http://loinc.org",
                            "code": "48018-6"
                        }
                    ]
                },
                "valueCodeableConcept": {
                    "coding": [
                        {
                            "system": "http://www.genenames.org/geneId",
                            "code": "HGNC:4931",
                            "display": "HLA-A"
                        }
                    ]
                }
            }
        ]
    }
}
```

## HLA-DPB1 Field

Field to report patient HLA for locus DPB1.
https://fhir.nmdp.org/ig/matchsync/StructureDefinition-hla-dpb1.html

```
{
    "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62fe",
    "resource": {
        "resourceType": "Observation",
        "id": "HLA-DPB1",
        "meta": {
            "profile": [
            "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/hla-genotype"
        ],
        "security": [
            {
                "system": "http://terminology.nmdp.org/codesystem/transplant-center",
                "code": "tc_123"
            }
        ]
    },
    "status": "final",
    "category": [
        {
            "coding": [
                {
                    "system": "http://terminology.hl7.org/CodeSystem/observation-category",
                    "code": "laboratory"
                }
            ]
```

```
        }
    ],
    "code": {
        "coding": [
            {
                "system": "http://loinc.org",
                "code": "84413-4"
            },
            {
                "system": "http://loinc.org",
                "code": "59017-4",
                "display": "HLA-DPB1 [Type] by High resolution"
            }
        ]
    },
    "subject": {
        "reference": "Patient/MSPatientExample"
    },
    "effectiveDateTime": "2022-05-01",
    "valueCodeableConcept": {
        "coding": [
            {
                "system": "http://glstring.org",
                "code": "hla#3.25.0#HLA-DPB1*04:01:01G+HLA-DPB1*04:02:01G"
            }
        ]
    },
    "specimen": {
        "reference": "Specimen/MSSpecimenExample"
    },
    "component": [
        {
            "code": {
                "coding": [
                    {
                        "system": "http://loinc.org",
                        "code": "48018-6"
                    }
                ]
            },
            "valueCodeableConcept": {
                "coding": [
                    {
                        "system": "http://www.genenames.org/geneId",
                        "code": "HGNC:4931",
                        "display": "HLA-DPB1"
                    }
                ]
            }
        }
    ]
}
```

## Form117 Fields

Field to report whether a patient is meeting form117 compliance requirements.

```
{
      "fullUrl": "urn:uuid:c3a35ccd-26aa-4a2d-a558-b382b8ea62f1",
      "resource": {
        "resourceType": "Observation",
        "id": "MSForm117ComplianceExample",
        "meta": {
          "profile": [
            "http://fhir.nmdp.org/ig/matchsource/StructureDefinition/ms-
form-117-compliance-observation"
          ],
```

```
          "security": [
            {
              "system": "http://terminology.nmdp.org/codesystem/transplant-
center",
              "code": "tc_123"
            }
          ]
        },
        "status": "final",
        "code": {
          "coding": [
            {
              "system": "http://terminology.nmdp.org/codesystem/nmdp",
              "code": "FORM117COMPLIANCE",
              "display": "Form 117 Compliance"
            }
          ],
          "text": "Form 117 Compliance"
        },
        "subject": {
          "reference": "Patient/MSPatientExample"
        },
        "effectiveDateTime": "2022-05-01",
        "valueBoolean": true
      }
    }
```

## FHIR Compliance

There are many tools that can be used to validate your FHIR payload and you can call the NMDP lower environment instance of Patient-Import as often as you like. In addition, here are instructions for installing a java-based validator. This solution takes advantage of the publicly available HL7 FHIR validator along with NMDP-specific FHIR constructs.

### Java-based FHIR Validator

*Prerequisite*:

- Gitlhub account
- Access to the DASH repo (contact the NMDP team for details)

**Download resources:**

Download validator jar from http://hl7.org/fhir/validator/ and save it in local directory like documents.

Clone the dash repo from https://github.com/nmdp-bioinformatics/dash

Copy the profiles folder from dash/dassh4/validation folder and put it in local directory like documents.

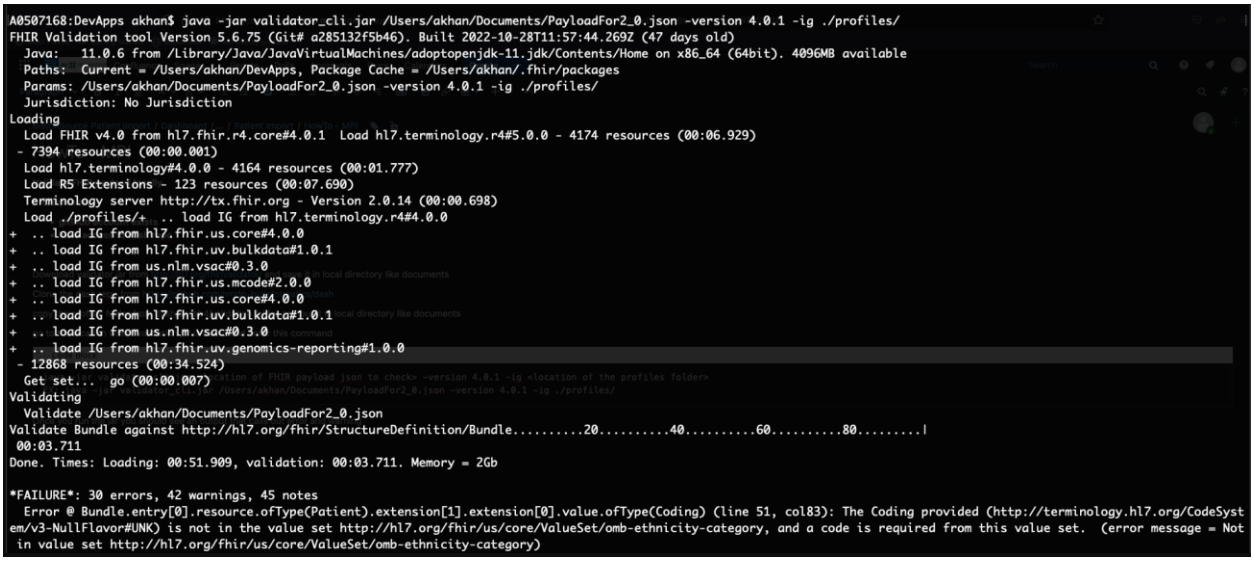
**Run the JAR**

Go to the location where validation jar is saved and enter below command:

```
java -jar validator_cli.jar <location of FHIR payload json to check> -
version 4.0.1 -ig <location of the profiles folder>

Example: java -jar validator_cli.jar /Users/akhan/Documents/PayloadFor2_0.json -
version 4.0.1 -ig ./profiles/
```

Once you run the jar you should see all warnings and errors.




If there are any errors other than the following known error, please resolve them.

### Known FHIR error:

```
Error @
Bundle.entry[0].resource.ofType(Patient).extension[1].extension[0].value.ofType(Co
ding) (line 51, col83): The Coding provided
(http://terminology.hl7.org/CodeSystem/v3-NullFlavor#UNK) is not in the value
set http://hl7.org/fhir/us/core/ValueSet/omb-ethnicity-category, and a code is
required from this value set.  (error message = Not in value
set http://hl7.org/fhir/us/core/ValueSet/omb-ethnicity-category)
```

## Error Handling

Error messaging largely follows standard HTTP response codes where 4xx errors indicate a problem with the caller (transplant center) and 5xx errors indicate a problem with the service (NMDP).

| | |
|---|---|
| 400 | Bad request (malformed, incomplete, cannot be processed) |
| 401 / 403 | Authorization issues (failed authentication, unauthorized access) |
| 405 | Method not allowed (POST=create, PUT=update, GET=health) |
| 500 | Internal server error (something went wrong on the server which can include authorization issues if a bad token is passed to Patient-Import) |
| 503 | Service is not available |
| 504 | Gateway timeout (response took too long) |

If there are validation errors related to your request, you'll receive a "400 Bad Request" response along with a description of the error. Here's an example:

```
{
    "code": 400,
    "message": "Patient data does not meet requirements to register in MatchSource, please provide correct data for [Patient communication.language.coding.code, HLA-DRB3/4/5 valueCodeableConcept.coding.code can only have two typings combined]"
}
```

A successful *create* call will return a "200 OK" response and include the generated patient ID:

```
{
    "id": "5676401"
}
```

This NMDP ID should be captured and stored by the caller to provide a mapping between the EHR system record (e.g. Epic) and the NMDP patient record. This ID is required for calls to the patient "*update*" feature.

# Helpful Links

## Patient-Import ***Test*** Environment

- **Version 3.0**

| | |
|---|---|
| FHIR IG: | https://fhir.nmdp.org/ig/matchsync/index.html |
| Sample Payload: | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/example/patient-payload-example.json |
| Swagger: | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/swagger-ui/index.html |
| API spec: | https://int-api.nmdp.org/int-matchsync-patient-import/3.0/api-docs |
| Service "create" endpoint (POST): | **https://int-api.nmdp.org/int-matchsync-patient-import/3.0/patient** |
| Service "update" endpoint (PUT): | **https://int-api.nmdp.org/int-matchsync-patient-import/3.0/patient/{RID}** |

## Patient-Import ***Production*** Environment

- **Version 3.0**

| | |
|---|---|
| FHIR IG: | https://fhir.nmdp.org/ig/matchsync/index.html |
| Sample Payload: | https://api.nmdp.org/p-matchsync-patient-import/3.0/example/patient-payload-example.json |
| Swagger: | https://api.nmdp.org/p-matchsync-patient-import/3.0/swagger-ui/index.html |
| API spec: | https://api.nmdp.org/p-matchsync-patient-import/3.0/api-docs |
| Service "create" endpoint (POST): | **https://api.nmdp.org/p-matchsync-patient-import/3.0/patient** |
| Service "update" endpoint (PUT): | **https://api.nmdp.org/p-matchsync-patient-import/3.0/patient/{RID}** |

***Match****Source*® (application login):

- Test environment: https://imatchsource-corebiz.nmdp.org/#/login
- Production environment: https://matchsource-core.nmdp.org/#/login

HL7 FHIR

- https://fhir.org/
- https://hapifhir.io/ (Java-tooling for FHIR and FHIR validation)
  - https://hapifhir.io/hapi-fhir/docs/getting_started/introduction.html
  - https://github.com/hapifhir/hapi-fhir (Spring support)
- https://fhir.nmdp.org/ (NMDP FHIR space)
- http://loinc.org (LOINC coding system)

Tools

- https://www.postman.com/ (Test tool for RESTful services)

# Addendum

## Sample: Minimum Required for a Successful “In-Progress” Create


```
{
  "resourceType": "Bundle",
  "meta": {
    "profile": ["http://fhir.nmdp.org/ig/matchsource/StructureDefinition/msbundle"],
    "security": [
      {
        "system": "http://terminology.nmdp.org/codesystem/transplant-center",
        "code": "tc_123"
      }
    ]
  },
  "type": "collection",
  "timestamp": "2024-02-14T21:30:20-05:00",
  "entry": [
    {
      "fullUrl": "urn:uuid:cc111e78-15eb-430d-b337-a4418494bedc",
      "resource": {
        "resourceType": "Patient",
        "meta": {
          "profile": ["http://fhir.nmdp.org/ig/matchsource/StructureDefinition/mspatient"],
          "security": [
            {
              "system": "http://terminology.nmdp.org/codesystem/transplant-center",
              "code": "tc_123"
            }
          ]
        },
        "name": [
          {
            "family": "Muntz",
            "given": [
              "Nelson",
              "B"
            ]
          }
        ],
        "gender": "male",
        "birthDate": "1976-03-09",
        "identifier": [
          {
            "use": "usual",
            "system": "http://terminology.nmdp.org/identifier/local-123",
            "value": "local3EpicId3003"
          }
```

```
        ],
        "communication": [
          {
            "language": {"coding": [
              {
                "system": "urn:ietf:bcp:47",
                "code": "ENG",
                "display": "English"
              }
            ]},
            "preferred": true
          }
        ],
        "managingOrganization": {
          "reference": "urn:uuid:413d5929-1fc5-43a4-ad48-e7ffe6af768c"
        }
      }
    },
    {
      "fullUrl": "urn:uuid:413d5929-1fc5-43a4-ad48-e7ffe6af768c",
      "resource": {
        "resourceType": "Organization",
        "meta": {
          "profile":
["http://fhir.nmdp.org/ig/matchsource/StructureDefinition/transplantcenter"],
          "security": [
            {
              "system": "http://terminology.nmdp.org/codesystem/transplant-center",
              "code": "tc_123"
            }
          ]
        },
        "identifier": [
          {
            "use": "usual",
            "system": "http://terminology.nmdp.org/identifier/transplantcenter",
            "value": "123"
          }
        ],
        "name": "<Human Readable Transplant Center Name>"
      }
    }
  ]
}
```