



HLA to FHIR: HML2FHIR

8/6/21

The logo graphic consists of a central dark blue circle. To its left is a grid of squares in two shades of blue, arranged in a pattern that suggests a digital or network structure. To the right of the central circle is a light blue gear-like shape with eight teeth, pointing towards the right. The text "HML Gateway" is written in white, bold, sans-serif font across the middle of the grid.

HML Gateway

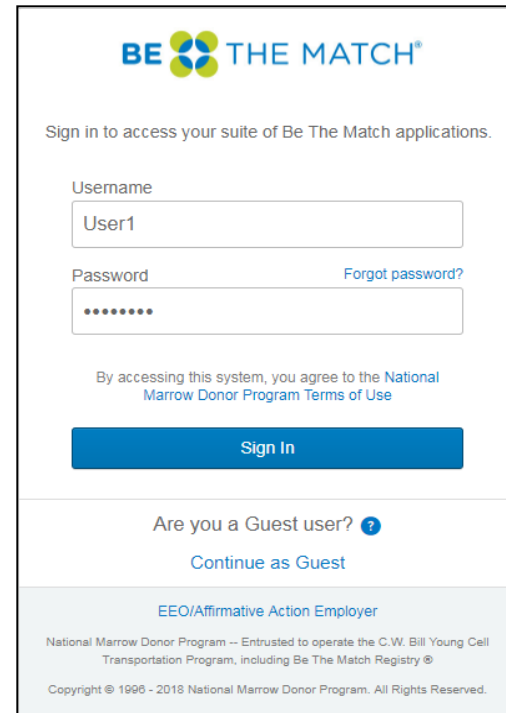
HML Gateway Overview

- NMDP's test result portal for transplant center and contract labs
 - HLA, CCR, BGA (ABO/RhD) and KIR result intake at recruitment
 - Patient and donor confirmatory (CT) results for unrelated transplants
 - Donor/Recipient Pairs Project results (DRPP) for research
 - HML2FHIR for CIBMTR
- Two HML Gateway web-based applications
 - a) [File Uploader – HML 1.0.1 and files with a .csv extension](#)
 - b) [Submission Dashboard – Test file management](#)
- Registry and DRPP results are directed to the NMDP's CORE components for in depth test result validation
- HML2FHIR results are directed to CIT's FHIR server



The Uploader UI – Manual File Submission

- Primarily used by labs during development of HML 1.0.1 or .csv files
- Can be used as primary mode of submission
- Guest and Authorized user views
- Three major functions: convert, validate and submit
- Convert adapts a CSV file to an HML 1.0.1 file
- Validate checks for correct HML 1.0.1 structure, and is accessible to all users
- Submit sends the file to the appropriate processor for additional checks and eventual result storage



The screenshot shows the Be The Match login page. At the top is the logo with the text "BE THE MATCH®". Below it is a heading "Sign in to access your suite of Be The Match applications." followed by two input fields: "Username" with the value "User1" and "Password" with masked characters "••••••". A link "Forgot password?" is next to the password field. Below the fields is a line of text: "By accessing this system, you agree to the National Marrow Donor Program Terms of Use". A blue "Sign In" button is centered below this text. At the bottom of the main section, there is a link "Continue as Guest" preceded by the text "Are you a Guest user?" and a question mark icon. A footer section contains the text "EEO/Affirmative Action Employer", "National Marrow Donor Program -- Entrusted to operate the C.W. Bill Young Cell Transportation Program, including Be The Match Registry ®", and "Copyright © 1996 - 2018 National Marrow Donor Program. All Rights Reserved."

Direct REST Submission

The REST payload requires:

1. HTTP "POST" request
2. Content type "application/xml"
3. Payload body which is the HML message itself
4. Okta Refresh token in the HTTP header (security/authorization)

Automation of submissions is possible with Postman



The screenshot shows the Postman interface for a POST request to `https://qa-api.nmdp.org/hml_gw/v1/submit`. The 'Headers' tab is selected, showing three headers:

KEY	VALUE	DESCRIPTION
<input checked="" type="checkbox"/> Authorization	Bearer abcdefghijklmnopqrstuvwxyz	
<input checked="" type="checkbox"/> Content-Type	application/xml	
<input checked="" type="checkbox"/> Connection	close	

Buttons for 'Send', 'Save', 'Cookies', 'Code', and 'Comments' are visible at the top right of the interface.



HML Gateway Dashboard UI

- Submission Management
- User AD account associated with submitter and lab roles
- Retains a complete history of laboratory submissions
- Status display and error handling
- Sample and test result information
- Search functionality
- FHIR indicator

BE THE MATCH Gateway Uploader Dashboard Miranda Bauer

Submissions

Notes	Resolved	TC Review	HML ID	Sample / Errors	Status	Received (CST)	Project Name	Reporting Center	Gene Family	Uploader File Name	UUID
	<input type="checkbox"/>	<input type="checkbox"/>	999534-010120177	1 / -	Success	2018-10-17 13:29:40	REG_CONFIRM_DNR	999	HLA		d3a8474e-410d-454f-0e55-57c9e53bce
	<input type="checkbox"/>	<input type="checkbox"/>	535999-999-03142017	1 / -	Success	2018-10-17 13:26:59	REG_CONFIRM_RCP	999	HLA		e3292946-d45a-428b-ae49-3219c3190a2e
	<input type="checkbox"/>	<input type="checkbox"/>	9992015122201034-3	1 / -	Success	2018-10-17 13:25:41	REG_CONFIRM_DNR	999	HLA		cc0b314-d81a-49e8-bece-35a0f1f82ba8
	<input type="checkbox"/>	<input type="checkbox"/>	99999903242015123-4	1 / 1	Failed	2018-10-17 13:23:19	REG_CONFIRM_RCP	999	HLA	Sanger Haplotids.html	32009aaf-97a5-49b7-0f50-9d753a5779a6
	<input type="checkbox"/>	<input type="checkbox"/>	999999-111215	1 / 1	Failed	2018-10-17 13:21:23	REG_CONFIRM_DNR	999	HLA	DD42.HML	8b3de777-963f-4564-b905-b8ec3680e9d3
	<input type="checkbox"/>	<input type="checkbox"/>	2.16.840.1.113999.3.14702017031901	1 / -	Success	2018-10-17 13:21:18	REG_CONFIRM_DNR	999	HLA	Donor Haplod HLA.html	a5c77844-606d-49a3-977d-cba3a8a79526
	<input type="checkbox"/>	<input type="checkbox"/>	001534-12-29-2016-10	1 / -	Success	2018-10-17 13:21:12	REG_CONFIRM_DNR	999	HLA	NGS gisting Ambiguities.html	0b4af91b-43f4-40b0-a0b0-1a82229a4917
	<input type="checkbox"/>	<input type="checkbox"/>	999999-08-18-2017	1 / -	Success	2018-10-17 13:21:10	REG_CONFIRM_DNR	999	HLA	NGS Haplod CT.html	496a0c1e-4390-479e-bb2b-77c0305a3521
	<input type="checkbox"/>	<input type="checkbox"/>	999999-12-19-2015-8	1 / -	Success	2018-10-17 13:21:01	REG_CONFIRM_DNR	999	HLA	SBT-NGS sanger Test.html	b9ab6541-895d-4aa3-ba2b-7b5b219594
	<input type="checkbox"/>	<input type="checkbox"/>	999999-12-29-2016-10	1 / -	Success	2018-10-17 13:20:59	REG_CONFIRM_DNR	999	HLA	999-SBT-NGS.html	aad09a0c-bf1a-4a83-9b0c-d34095076136
	<input type="checkbox"/>	<input type="checkbox"/>	999999-12-18-2015-1	1 / -	Success	2018-10-17 13:20:55	REG_CONFIRM_RCP	999	HLA	SBT-sanger glistings.html	ef8fc51e-cd7f-4864-adae-4579cd7954a5
	<input type="checkbox"/>	<input type="checkbox"/>	99539999-11277	1 / -	Success	2018-10-03 09:00:13	REG_CONFIRM_DNR	999	HLA	SBT-NGS Separate Haplotids	a6b184d7-b674-4eea-9b75-5d2787085c29
	<input type="checkbox"/>	<input type="checkbox"/>	518485047564	14 / -	Success	2018-09-28 09:12:31	REG_CONFIRM_DNR	999	HLA		f140b09e-828b-48c0-9b65-8525a65a4330

[Extract](#) Items per page: **100** 1 - 21 of 21 |< < > >|

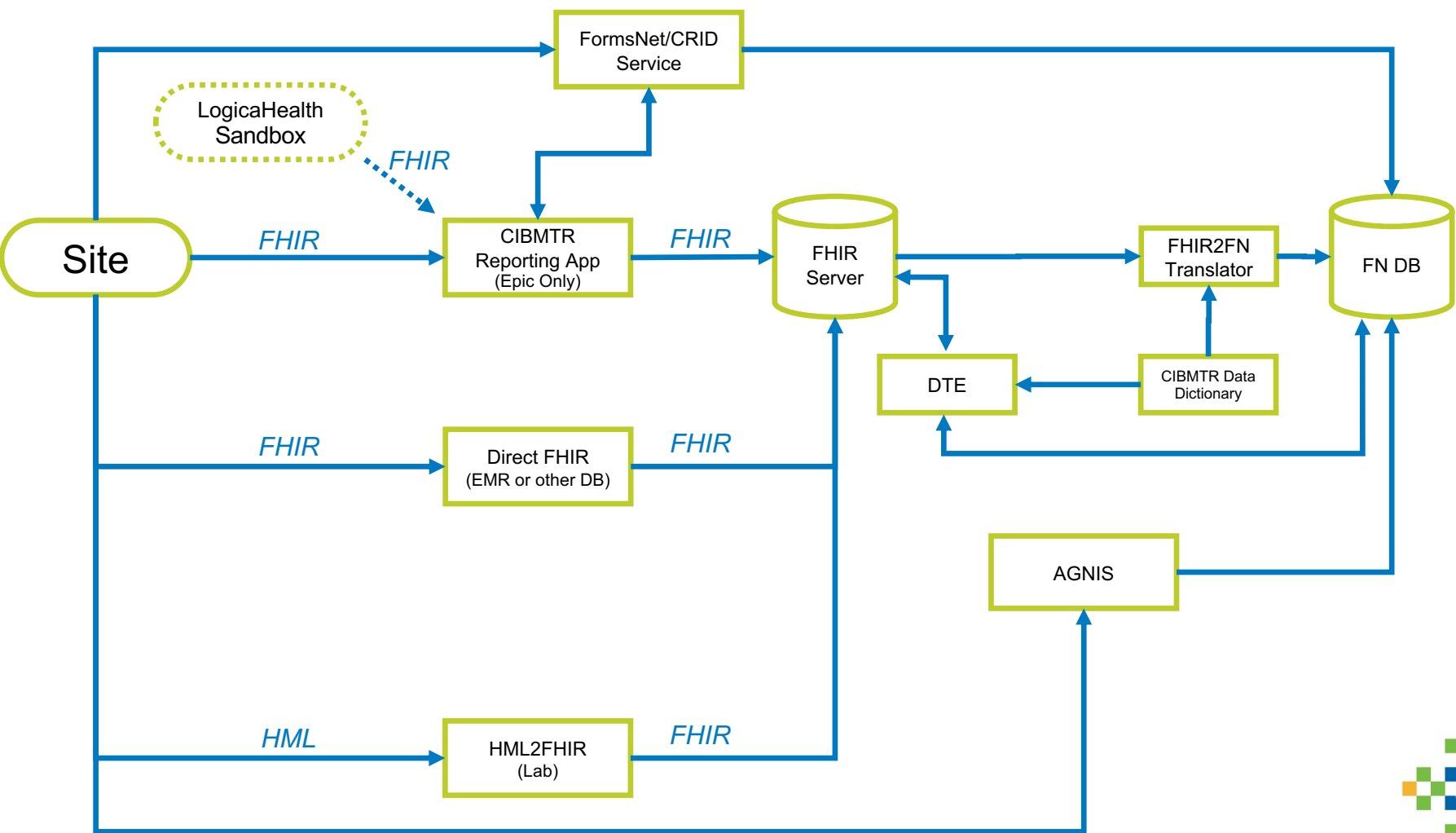
Version: 0.2.38
National Marrow Donor Program - Established to operate the F-08 SBT Young Cell Transplantation Program. Invaluable To The Match Registered

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Copyright © 1998-2017 National Marrow Donor Program. All Rights Reserved.



The logo features a stylized gear with a circular center, composed of various shades of blue. To the left of the gear is a cross-like shape made of squares, also in shades of blue. The text 'HML2FHIR' is written in white, bold, sans-serif capital letters across the center of the cross shape.

HML2FHIR

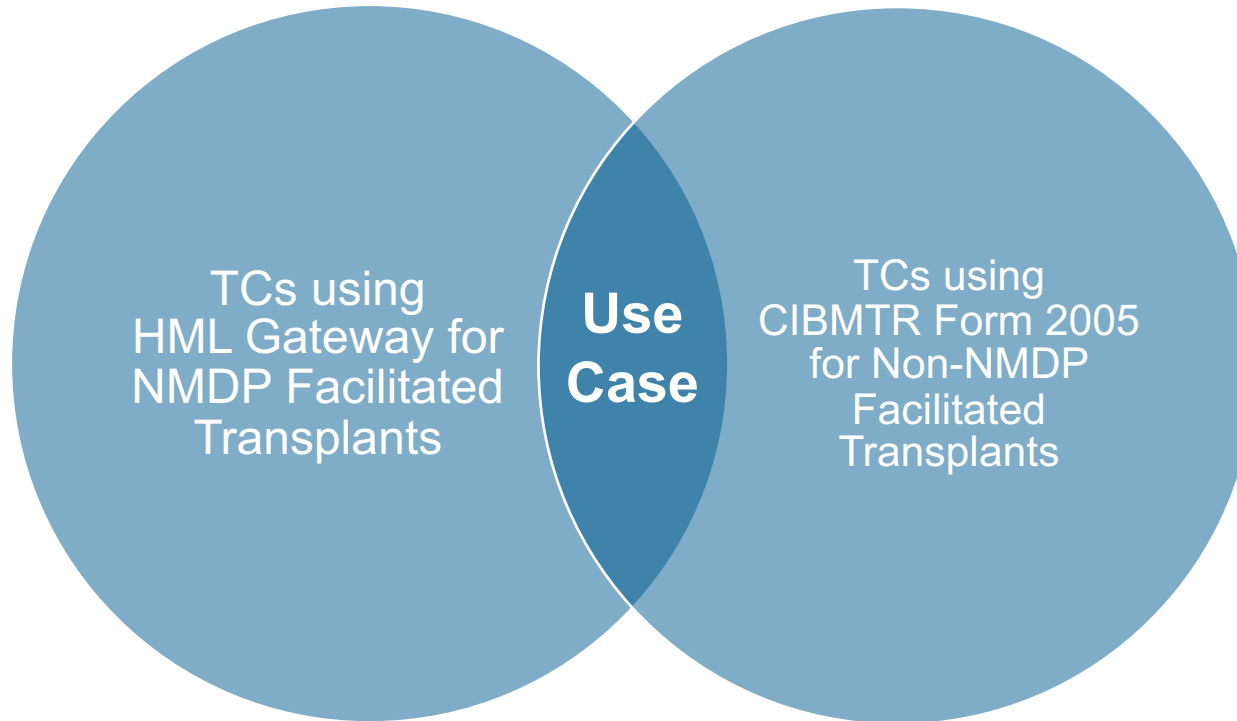


HML2FHIR

- Converts HML 1.0.x to FHIR transaction bundle
 - FHIR R4
 - conforms to early version of Genomics Reporting IG
- Open Source
 - <https://github.com/nmdp-bioinformatics/hml-fhir-app>
- Stepping stone for labs/vendors to develop FHIR exports
 - Provides example code
- Currently using NMDP house rules for HML Gateway
 - e.g., one HLA locus per typing
- Integration with NMDP HML Gateway



CIBMTR HLA Use Case



CIBMTR HLA Use Case

- Electronic reporting of HLA to CIBMTR for non-NMDP facilitated transplants through the NMDP HML Gateway
- If patient/donor HLA typing has been submitted to NMDP via electronic form 22 or 117, the Transplant Center does NOT need to re-submit CIBMTR Form 2005 (CIBMTR collects this data from NMDP)
- This specification is only for reporting patients/donors/etc that are normally reported through CIBMTR FormsNet Form 2005 (non-NMDP facilitated transplants).



CIBMTR Rules for HML

- Use NMDP HML Gateway rules
 - Contact donorlabservices@nmdp.org for more information
 - If you can already successfully submit HML to the NMDP HML Gateway for submitting electronic Form 22/117, you are compliant with the rules.
- You can check your HML for compliance to HML Gateway rules using the validation end point
 - https://qa-api.nmdp.org/hml_gw/v1/validate



CIBMTR specific HML data elements

- hml project-name
 - Patient receiving the transplant
 - RES_CIBMTR_FHIR_RECIPIENT
 - Hematopoietic cell donor
 - RES_CIBMTR_FHIR_DONOR
 - Cord blood unit
 - RES_CIBMTR_FHIR_CBU
 - Mother of the cord blood unit
 - RES_CIBMTR_FHIR_CBUMOTHER
 - Non-donor, but of interest (e.g., mother of patient)
 - RES_CIBMTR_FHIR_NONDONOR



CIBMTR specific HML data elements (cont)

- sample id
 - recipient = [CRID]
 - CIBMTR Research Identifier
 - donor = [donor id] (e.g., [GRID])
 - e.g. Global Registration Identifier for Donors
 - <https://www.wmda.info/professionals/optimising-search-match-connect/why-global-identifier>
 - cord blood unit = [cbu id]
 - non-donor = [specimen id]
- sample center-code
 - CIBMTR center code



Optional – HML Property Elements

- HML allows for property elements containing name/value pairs. The content of this element must be coordinated between sender and receiver. This is not validated by the validator described above
 - `<property name="name" value="value" />`
 - See <http://schemas.nmdp.org/>
- If the property elements described here are included for each sample, Form 2005 will be considered complete.



Optional – HML Property Elements (cont)

- For non-recipient HLA, two property elements are used to capture the CRID of the transplant recipient, and the relationship of what is being typed to the recipient.
 - name="CRID"
 - needed for non-recipient typings
 - value="[CRID]"
 - name="recipient-relationship"
 - relationship between the specimen being typed and the transplant recipient
 - value="[recipient-relationship]"



Possible values for recipient-relationship

- fraternal-twin
- identical-twin
- full-sibling
- half-sibling
- child
- cousin
- father
- mother
- uncle
- aunt
- nephew
- niece
- grandparent
- grandchild
- other-relative
- unrelated



Example: Recipient HLA (property not needed)

```
<hml xmlns="http://schemas.nmdp.org/spec/hml/1.0.1"
xmlns:proc="http://hl7.org/fhir"
xmlns:xsi="http://www.w3.org/2500/XMLSchema-instance"
xsi:schemaLocation="http://schemas.nmdp.org/spec/hml/1.0.1"
project-name="RES_CIBMTR_FHIR_RECIPIENT"
version="1.0.1">
...
  <sample id="[CRID]" center-code="[transplant center id]">
    ...
  </sample>
...
</hml>
```



Example: Unrelated Donor HLA

```
<hml xmlns="http://schemas.nmdp.org/spec/hml/1.0.1"
xmlns:proc="http://hl7.org/fhir"
xmlns:xsi="http://www.w3.org/2500/XMLSchema-instance"
xsi:schemaLocation="http://schemas.nmdp.org/spec/hml/1.0.1"
project-name="RES_CIBMTR_FHIR_DONOR"
version="1.0.1">
...
  <sample id="[donor id]" center-code="[transplant center id]">
    ...
    <property name="CRID" value="[CRID]" />
    <property name="recipient-relationship" value="unrelated" />
    ...
  </sample>
...
</hml>
```



Example: Related Donor HLA (mother)

```
<hml xmlns="http://schemas.nmdp.org/spec/hml/1.0.1"
xmlns:proc="http://hl7.org/fhir"
xmlns:xsi="http://www.w3.org/2000/XMLSchema-instance"
xsi:schemaLocation="http://schemas.nmdp.org/spec/hml/1.0.1"
project-name="RES_CIBMTR_FHIR_DONOR"
version="1.0.1">
...
  <sample id="[donor id]" center-code="[transplant center id]">
    ...
    <property name="CRID" value="[CRID]" />
    <property name="recipient-relationship" value="mother" />
    ...
  </sample>
...
</hml>
```



Example: Cord Blood Unit

(property recipient-relationship not needed)

```
<hml xmlns="http://schemas.nmdp.org/spec/hml/1.0.1"
xmlns:proc="http://hl7.org/fhir"
xmlns:xsi="http://www.w3.org/2000/XMLSchema-instance"
xsi:schemaLocation="http://schemas.nmdp.org/spec/hml/1.0.1"
project-name="RES_CIBMTR_FHIR_CBU"
version="1.0.1">
...
  <sample id="[CBU id]" center-code="[transplant center id]">
    ...
    <property name="CRID" value="[CRID]" />
    ...
  </sample>
...
</hml>
```



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..



examples

added hml examples



src

dass4, scripts and examples for directfhir and hml2fhir



HML-CIBMTR2005-20200409.pdf

added hml2fhir doc





master

dash / dassh4 / hml2fhir / examples /



bmilius-nmdp added hml examples

..



DaSSH_CIBMTR_HML_Donor.hml.xml

added hml examples



DaSSH_CIBMTR_Recipient_1.hml.xml

added hml examples



DaSSH_CIBMTR_Recipient_3_Class_I_PacBio.hml.xml

added hml examples



DaSSH_CIBMTR_Recipient_2.hml.xml

added hml examples



E22_glstring_example.hml.xml

added hml examples



E22_glstring_example_cibmtr.hml.xml

added hml examples



E22_haploid_example1.hml.xml

added hml examples



E22_haploid_example1_cibmtr.hml.xml

added hml examples



E22_haploid_example2.hml.xml

added hml examples



E22_haploid_example2_cibmtr.hml.xml

added hml examples



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bmilius-nmdp dassh4, scripts and examples for directfhir and hml2fhir ...

..



hml_REST.pl

dassh4, scripts and examples for directfhir and hml2fhir



hml_REST.py

dassh4, scripts and examples for directfhir and hml2fhir



A decorative graphic on the left side of the slide. It features a light blue gear with eight teeth, positioned behind a trail of squares. The trail starts from the left edge and moves towards the gear, with squares becoming more transparent as they approach the gear. The text "Thank you!" is written in white on a dark blue rectangular background, which is part of the trail.

Thank you!

