



Numbering Strategy

Care Information Exchange



Document History

Version	Date	Author	Notes
1.0	12/06/2015	Thomas Pick	First version for review.
1.1	15/06/2015	Thomas Pick	Some clarifications made after feedback.
1.2	06/07/2015	Thomas Pick	Added information about auto-creating medical records.
1.3	10/07/2015	Thomas Pick	Edited to note that an Organisation or Team can now have multiple local IDs.
1.4	13/07/2015	Thomas Pick	Added a note indicating that PKB does not currently make use of the NHS number status.
1.5	27/08/2015	Thomas Pick	After technical discussions, adding an explanation of how we will process NHS number status. Flowchart added as an appendix.
1.6	14/09/2015	Thomas Pick	Adding some explanatory text regarding the ability to create a record without an NHS number first, and then subsequently add one later.
1.7	26/10/2015	Thomas Pick	Adding information about Forename (short) option for soft matching. Updating workflow in appendix, and added a comment noting requirement for NHS number when update demographics of record with an NHS number.
1.8	05/11/2015	Thomas Pick	Adding link to email address handling document. Rewording to make it clear that NHS number is optional. Removing restriction for HL7 sender to have access to medical record. Other minor changes for clarity.
1.9	13/12/2015	Thomas Pick	Adding details of forename (initial) option and also specifying NWL CIE soft demographics configuration.
1.10	12/01/2016	Thomas Pick	Adding new version of the flowchart in Appendix A to make it clear that at least one valid ID must be provided to create a new medical record.
1.11	13/09/2016	Thomas Pick	Updated some terminology, screenshots, and links. Clarified that invalid national ID values will cause an HL7 message to be rejected. Clarified explanation of local ID scope and added to link to more comprehensive online documentation. Automatic invitation flow for HL7 messages marked as "not yet implemented".



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Overview

Patients Know Best stores one medical record for each patient. It is therefore essential that a common numbering strategy is used to ensure that data from multiple organisations can be linked to the same medical record within PKB.

This document outlines the numbering strategy to be used across the Care Information Exchange (CIE) environment. It covers how medical records will be identified, how data will be matched to those records, and the issues surrounding merging will be discussed (although merging is not yet supported). This document gives priority to discussion about the HL7 API, but is intended to cover issues applicable to the entire system.



Numbering

The sections below describe the identifiers that are available to uniquely identify a PKB medical record.

Relevant PKB Design Principles

- PKB divides customer sites into Organisations, which contain one or more Teams.
- A medical record can be linked to multiple Organisations and multiple Teams.
- A medical record can have zero to many Organisation Level IDs for each Organisation it is linked to.
- A medical record can have zero to many Team Level IDs for each Team it is linked to.
- A medical record can have zero or one National ID for each National ID Type.
- An HL7 message must contain at least one identifier, which must be either a National ID, an Organisation Level ID, or a Team Level ID.
- HL7 identifiers are allowed in either PID-2 or PID-3. PKB will combine these lists into one list for processing. Neither the PID field an identifier appears in, nor its position within this field, is meaningful to PKB.
- All HL7 identifiers need to include:
 - ID (component 1)
 - Assigning Authority (component 4)
 - Identifier Type Code (component 5)

Please see [our online docs](#) for more details of how we process HL7 identifiers.

National Identifiers

PKB supports national identifiers. In England, this is the NHS number. A medical record may be associated with zero or one NHS numbers.

A PKB medical record can be associated with more than one type of national identifier. For example, a patient might also have an Irish Personal Public Service Number. But in each case a medical record can only be associated with zero or one instance of each type of national identifier.

For NHS numbers in HL7 messages, note the following restrictions:

ID	May contain spaces or dashes, but these will be removed upon receipt
Assigning Authority	Must be: NHS
Identifier Type Code	Must be: NH (but see note below)

National Identifier Validation

Note that if a National ID is provided which does not match the validation rules for the



corresponding National ID Type (e.g. checksum fails) then the HL7 message will be rejected.

NHS Number Status

In addition, note that the NHS number can optionally include a status code, as [defined in the NHS Data Dictionary](#). If present, the status code is supplied with the identifier type code, in the format NH{status:XX} where XX is the status code. For example:

NH{status:01}

There must be no space between “NH” and the status code. Since the status code is optional, “NH” remains a valid identifier type code.

See the section on matching below, and also Appendix A, for details of how the status code is used.

Local Identifiers

PKB supports local identifiers. A local identifier is either an Organisation Level ID or a Team Level ID. The scope of a local ID is constrained to the Organisation (for Organisation Level IDs) or the Team (for Team Level IDs) with which the type is associated. For example, an MRN of 00001 from Hospital One will not clash with the same MRN value from Hospital Two, assuming that Hospital One and Hospital Two were each configured as distinct Organisations and their MRNs respectively configured as a type of Organisation Level ID.

A medical record can be associated with zero to many local IDs for each Organisation it belongs to, and zero to many local IDs for each Team it belongs to. Since Teams are nested inside Organisations, a patient can have departmental specific identifiers in addition to their hospital MRN. For example, a medical record might be associated with all of the following:

- One NHS number
- One MRN for Hospital One
- Two MRNs for Hospital Two
- One GUM ID for Hospital Two GUM clinic

In order to handle identifiers correctly, each Organisation and Team must agree with PKB which Assigning Authority and Identifier Type Code will be used for each local identifier, before any data is sent.

Any HL7 provided identifiers which do not match the relevant configured information will be ignored.

PKB ID

Each PKB user is associated with a unique numerical identifier - the PKB ID. This is used internally and also by the REST API. For example, the REST operation to [deactivate a user](#) requires that the internal PKB ID is supplied to identify the user to deactivate.



Email Address

An email address that has been confirmed (i.e. the user has clicked on a validation link sent to that email address) can only ever be associated with one user in PKB. As such, this uniquely identifies that user, and allows the email address to be used as a username to access the web interface. However, the email address is never used in the HL7 matching process when adding data to a medical record (see below for more info on matching).

Note - some users can be associated with multiple PKB accounts. As such, although the email address will uniquely identify the user, it will not uniquely identify the role that user is performing (e.g. they might have a Professional login for two different Teams).

See [here](#) for full details of how email addresses are handled.

CIE Numbering Policy

In order to ensure consistency across the CIE environment, it has been agreed that the NHS number will be the primary means of identifying patients. Connecting organisations should use the NHS number wherever possible, and include it in HL7 messages when known.

However, the NHS number remains an optional identifier; there are some situations where an NHS number is not available. For example, a connecting organisation can continue to send data about private patients using only local identifiers. There is no requirement that an NHS number is added.

See the section “Soft Matching (Demographics & NHS Number Status)” below for information about how PKB will process the NHS number status.

See the section “CIE Merging Policy” below to understand the implications for patients that have an NHS number but which is not added to their account straight away.



Matching

Hard Matching (Identifiers)

In order to identify a medical record, PKB must be able to match that medical record using at least one identifier. The table below shows which identifiers are acceptable for each of our APIs.

API	National	Local	PKB ID
HL7	Y	Y	
REST	Y	Y	Y

When data is received, all the supplied identifiers will be used to search for matching medical records. If no matches are found, an error will be returned, except when 1) the operation was intended to create the corresponding medical record, e.g. an [HL7 A28 message](#), or 2) the HL7 interface is configured to auto-create medical records when a match is not found. If multiple matches are found, an error will be returned.

Soft Matching (Demographics & NHS Number Status)

Messages other than record creation and demographic updates

PKB's HL7 API supports optional validation of demographic information. If enabled, the selected fields in HL7 PID segments are compared to the patient demographics stored in the PKB record. The table below shows the fields available for matching.

Note: soft matching is only currently available for the HL7 API. We do not yet support this for the REST API.

Field	Matching criteria
Surname	Approximate (ignores case and punctuation)
Forename (full)	Approximate (ignores case and punctuation)
Forename (short)	Approximate (ignores case and punctuation). As Forename (full), except the matching is performed only up to the length of the shorter of the two values being compared, e.g. Jo matches Joanne
Forename (initial)	Approximate (ignores case and punctuation).



	Will compare only the first initial of the forenames.
Postal code	Approximate (ignores case and punctuation)
Gender	Approximate (ignores case)
DOB	Exact

Each HL7 interface can be configured independently. Any combination of the above identifiers can be used to perform soft matching.

Additionally, note the matching criteria for each field. Approximate matching is done on textual fields. For example, a provided surname of “LEBON” will match a stored surname of “Le Bon”.

In contrast to hard matching, a soft matching failure will not cause the HL7 message to be rejected. Instead, the data points from the message are flagged as pending manual review. Whilst in this state they will not be included in data returned for this medical record. The manual review needs to be conducted by an Organisation Administrator. PKB will work with customer sites to assign someone into this role. The Organisation Administrator web interface offers a facility to review, and subsequently approve or reject, any messages which have failed soft matching. An example screenshot is given below.

HL7 Messages for review: Mismatched patient info

<input type="checkbox"/>	For patient	Received	Destination	Mismatch details
<input type="checkbox"/>	9875803464 Patient	03-Jun-2016	TEST_RESULT	dateOfBirth PKB: 1980-01-01, HL7: 1990-01-01

Approve selected Reject selected 1 to 1 of 1

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Your support code is 39106a20160913103621 Powered by Patients Know Best



Record creation and demographic update messages

Some messages cannot be soft-matched based on demographics.

- When creating a new medical record there is no prior demographic information to match against.
- When updating the demographic information on an existing medical record we must allow the message to change the existing demographic data, rather than match what is already stored.

Instead, PKB can optionally configure an interface to soft-match these messages based on the NHS number status. If this option is enabled, and an NHS number is provided, then PKB will check that the status is present and equal to “01” before creating or updating the medical record. If the check fails, then:

- If the target medical record does not exist, PKB will ignore the NHS number and behave as if it had not been provided.
- If the target medical record does exist, PKB will queue the message as needing manual review. A human must then manually confirm that the unverified demographic changes are correct.

In addition, if NHS number status checking is enabled, then an NHS number must be provided to update the demographics information of a medical record that already has an NHS number associated with it.

CIE Matching Policy

CIE will enable the NHS number status checking on the HL7 interfaces. See above for the implications.

CIE interfaces must be configured with the following soft demographic checks enabled:

- Surname
- Forename (initial)
- DOB

Implications of Sending an Unverified NHS Number

As noted above, the CIE policy is to enable checking of NHS number status.

If a medical record is created without an NHS number (either because it wasn't sent, or because it was ignored due to its verification status) then an NHS number can always be added at a later date. For example, if a message is received containing an MRN of 123, and an NHS number of 5555555555 (status 02), then the medical record will be created just with an MRN of 123. Subsequently, if a message is received with an MRN of 123 and an NHS number of 5555555555 (status 01), then the medical record will be matched based on the MRN and the NHS number added at that time, since it has now been verified.

The benefits of this approach are that it should help to reduce the rejection rate of HL7



messages, whilst also helping to avoid incorrect identifiers being applied to a medical record. However, until automatic merging is implemented by PKB then there is a small risk that someone else adds the NHS number of 555555555 to a different medical record before the first sender had time to verify it. This would then need manually resolving with assistance from PKB support (see below).



Merging

PKB has been designed to hold one medical record about each patient. However, real world integrations might result in a situation where multiple medical records exist about a single patient. As such, we need to be able to merge two medical records into one. There are two distinct scenarios where this could happen. They are addressed in turn below, but note that **neither are currently supported** by PKB (although they are on the roadmap to be supported in the future).

Explicit Merge Requested

Frequently, a hospital will generate two distinct medical records for the same patient, each with a distinct local ID. This could be for a number of reasons, including human error.

The hospital Patient Administration Systems (PAS) will typically use an HL7 merge message (e.g. A40) to indicate that data from one medical record (the "losing" record) should be merged into another medical record (the "winning" medical record).

PKB does not yet support any such merge messages.

Automatic Merge Identification

Imagine that Hospital One has created a PKB medical record for a patient. This record has the patient's NHS number and a local Hospital One MRN assigned.

Then, the patient turns up to Hospital Two emergency department, and is treated without their NHS number being known. Hospital Two might then create a new PKB medical record with just a Hospital Two MRN assigned.

Now there will be two PKB medical records for the same patient.

If Hospital Two subsequently identifies the patient's NHS number (e.g. by a [Spine](#) trace), they will try to add it to the patient's medical record via an update message. PKB will currently reject this message because we do not permit a unique identifier (in this case, NHS number) to be associated with 2 separate medical records. However, Hospital Two does not know anything about the first medical record, so they won't understand why the update failed.

In this scenario PKB could automatically identify that the two records are candidates for merging. However, this functionality is not yet supported.



CIE Merging Policy

The following sections outline the limitations caused by a lack of merge support.

Limitations due to lack of support for explicit merges

Since a Trust cannot request an explicit merge, then if two distinct medical records are created for the same patient, only one can store the national ID. If a clinician subsequently searches using this national ID, the record without the national ID will not be returned, and the clinician might not realise the record exists. However, note that the data will still exist in PKB, and will be discoverable if the clinician were to search by e.g. name.

Limitations due to lack of support for automatic merges

It is possible that two (or more) existing customers of PKB have medical records in PKB that relate to the same patient, but where only one (or none) of the Trusts has assigned the NHS number to the record. If the second Trust subsequently tries to add the NHS number then the update will fail, because PKB will recognise that the number already belongs to an existing medical record, and duplicates are not allowed. It is expected that this will be rare, and will need manually resolving should it occur.

This problem can be partially mitigated by asking all trusts to attempt to assign an NHS number to all existing patients (this can be done manually via the web interface) before enabling their data feeds. This will give early warning of these problems, since any errors when trying to add the NHS number can be detected before the data feeds are turned on.



Appendix A: Hard and Soft Matching Flowchart

This flowchart outlines how PKB will match a medical record upon receipt of an HL7v2 message.

Please click the link below for a larger version.

<https://www.lucidchart.com/publicSegments/view/55d44637-e2a4-47cf-b768-0d9f0a0091e5/i/mage.png>

